EG&G
A Division of URS

S: January 3, 2008

GM1149-07

December 20, 2007

Ms. Linda Rae Johnson
Administrative Contracting Officer
Department of the Army
Army Sustainment Command
11680 Stark Road
Stockton, Utah 84071

RE: Contract DACA87-89-C-0076 - Tooele Chemical Agent Disposal Facility (TOCDF)

SUBJECT: Heel Transfer System-Full Scale Proof of Concept Test-Final Test Report

Dear Ms. Johnson:

Please find enclosed a copy of the Final Test Report for the Heel Transfer System (HTS), Full Scale Proof of Concept Test. This copy is being provided for your review. Any comments should be submitted by January 3, 2008 for consideration.

EG&G has proceeded into the design phase of the final HTS based upon the results of this test. A revised schedule for design, fabrication, installation and systemization of the HTS will be rolled into the TOCDF Integrated Working Schedule by January 4, 2008.

If you should require additional information and/or clarification regarding this test report, please contact me at ext. 6782.

Sincerely,

Timothy L. Hutson
Project Manager

TLH/kb

cc: Thaddeus A. Ryba Jr., TOCDF Site Project Manager

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TOCDF
Heel Transfer System
Full Scale Proof of Concept Test
Final Test Report

December 19, 2007

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1. Executive Summary

A simplified test apparatus emulating the proposed Heel Transfer System (HTS) was installed at TOCDF in the Munitions Processing Bay (MPB) and the corridor just outside the MPB for execution of a full scale Proof of Concept test. This test apparatus was used to process twenty mustard ton containers (TCs) which had been drained of agent and contained a residual heel weight ranging from 545 to 922 pounds.

Each TC (called a Parent TC) was processed using a controlled volume of 3000 psig, 120°F water sprayed into the TC to breakup and emulsify/dissolve a portion of the heel so that it could be transferred (pumped). The resulting slurry, called rinsate, was then transferred from the Parent TC to an empty TC (called the Child TC) to reduce the weight of the Parent such that it could be processed through the Metal Parts Furnace (MPF) in compliance with the TOCDF operating permit (maximum 630 pounds). The resultant Child TC was similarly processed through the MPF.

The Proof of Concept Test demonstrated satisfactory operation of the HTS test apparatus over a wide range of initial heel weights and physical consistencies. The twenty TCs processed were pulled from fifteen different lots to ensure a wide variety of heel characteristics were tested. In all cases the HTS process yielded results better than the minimum design objectives.

A key test objective was to determine the approximate, minimum amount of water which would be required to liquefy a specific quantity of the heel. The minimum quantity of water required was found to be variable depending upon the initial mass of heel so a more effective parameter for measuring the effectiveness of the water was the “heel removed” to “water sprayed” ratio. For the twenty tests performed, the heel to water ratio varied between a low of 1.3 and a high of 3.0 with an average of about 1.93. This was greater than the minimum design objective of 1.0.

Equally important in the overall impact of the Heel Transfer System is the time it takes to process Child TCs through the MPF. Test data was acquired for a variety of Child TC rinsate weights and heel/water ratios showing trends relative to these parameters. Data indicates that a 600 pound child with a 2:1 heel/water ratio can be processed through zone 1 of the MPF in approximately 150 minutes yielding a processing rate of 4 pounds/minute. This comfortably exceeded the design objective of 3.2 pounds/minute which was based on processing a 450 pound heel in 142 minutes.

2. Background

EG&G Defense Materials Inc. operates the Tooele Chemical Agent Disposal Facility (TOCDF) for the U. S. Army’s Chemical Materials Agency (CMA), in Stockton, Utah. The final phase of the project is the elimination of mustard filled TCs and projectiles.

Sampling in Area 10 has revealed that a large number of the TCs are contaminated with mercury and/or contain excessive sediment called “high heel”. High heel TCs can not be processed with existing, baseline TOCDF equipment and still ensure compliance with environmental regulations and/or facilitate cost effective processing times. TOCDF is limited by its operating permit to processing TCs through the MPF that have a heel weight less than or equal to 630 pounds (aka, “low heel TCs”). Sampling operations in Area 10 have allowed EG&G to identify those TCs which have low mercury contamination and are likely to be low heel TCs. The first, on-going phase of the mustard TC campaign is processing TCs with low liquid mercury (Hg) concentration and low heel weight. TCs with high liquid Hg concentration and/or high heel weight will be processed last in phases two and three of the TC campaign.

For phases two and three, EG&G will design and install a system called the Heel Transfer System (HTS) which will use a high pressure/hot water (HP/HW) spray to dissolve/liquefy the heel in a high heel Parent TC and transfer a portion of it to a Child TC on the opposite processing line. The parent TC, with its weight reduced to an acceptable level, and the Child TC will be processed through the MPF.

To support the design of this system and to test some of the concepts associated with the design, EG&G designed and installed test equipment which emulated the equipment and concepts proposed for the HTS design.

3. Test Objectives

The following test objectives were stated in the Heel Transfer System Full Scale Proof of Concept Test Plan:

3.1. It should be noted that the Proof of Concept Test is not a “test” in the conventional test sense. Rather it is a demonstration test during which a variety of data will be collected to demonstrate the concept. Accordingly, there are no acceptance criteria for each of the tests that were conducted. Upon completion of all the testing, data will be analyzed and calculations will be performed to estimate the aggregate, rinse-water to heel-removed ratio for the entire DCD stockpile. This ratio will be compared to the 1:1 rinse-water to heel-removed assumption currently specified in the TOCDF Life Cycle Cost Proposal, schedule and cost impacts will be determined, and an overall assessment of the HTS will be made.

3.2. Demonstrate the principle that a 120°F, 3000 psig water spray can be utilized to effectively breakup/dissolve a portion of the heel present in a TC such that it can be pumped from the TC and transferred to another container. This “effectiveness” will largely be dependent on the quantity of water required by the process and the resultant quantity of rinsate generated by that amount of water.

3.3. Determine how much heel is liquefied/mobilized to a pumpable state by varying the quantity of 120°F, high pressure water spray. Data will be acquired for several volumes of spray water, and a range of heel masses which will vary from 550 to 850 pounds. It is anticipated that the more spray water that is used, the more heel will be removed up to a point of diminishing returns. It is further expected that this relationship will likely be dependent on how much heel is present to start with. Accordingly, the objective will be to determine the amount of water required to reduce the heel weight to less than 490 pounds, depending on the initial weight of heel present. This relationship will be used to make projections about the quantity of rinsate which will be generated by the HTS, and the corresponding number of child TCs which will need to be processed through the MPF.

3.4. Determine whether or not "soak time" is helpful in maximizing the amount of heel removed for a given amount of hot water initially sprayed in.

3.5. Utilize the prototype HTS equipment in order to demonstrate:

  3.5.1. Spray wand operation
  3.5.2. Spray nozzle effectiveness
  3.5.3. Transfer pump effectiveness
  3.5.4. Drain tube operation

3.6. Visually inspect (and videotape) heels in the test TCs prior to and after spraying to document the physical characteristics and distribution of the heel in the TC and the effectiveness of the prototype spray and drain system. This data will be analyzed for its potential impact on the test results.

3.7. Make a subjective determination as to the quantity and diameter of the heel "chunks" that are transferred using this process. This information will contribute to the pump selection process during the design of the HTS.

3.8. Determine the time required to process Child TCs through the MPF. This will allow the following related objectives to be achieved:

  3.8.1. Establish a correlation between the weight of rinsate processed in a Child TC, the organic concentration of the Child TC, and the time required for vaporizing the rinsate in the Child TC.
  3.8.2. Determine the maximum Child TC rinsate weight that can be processed through the MPF using existing MPF Zone times and Zone 1 temperature.

3.9. Determine the processing time impact of applying the HTS process to TCs with heels in the range of 550 – 630 pounds. Although the primary purpose of processing TCs in this range is to reduce the number of MPF operational upsets due to boil-overs, an added benefit is that the Parent TCs can be processed as L4s which take 20 minutes less time in the MPF. Depending on the amount of rinsate generated for each TC, this will partially, or perhaps completely, offset the additional time required to process the Child TCs generated.

4. Test Setup

The Proof of Concept test was designed to emulate the proposed HTS design as much as possible. It consisted of the following primary components:

- HP water pump
- Hot water heater
- HP spray wand with vertical linear drive unit
- Drain Tube with vertical linear drive unit

- Rinsate Transfer Pump
- Child TC (a TC previously processed through the MPF)

Utilizing these temporary components, 120°F, 3000 psig water was sprayed into a TC which had been punched and drained. After a predetermined amount of water was sprayed into the heel, the water spray was stopped. The rinsate drain tube was inserted, the Rinsate Transfer Pump was started, and the generated rinsate was drawn from the parent TC and transferred to the child TC. The general layout of the test assembly configuration is shown on Figures 4.1 and 4.2. The P&ID for the test is shown on Figure 4.3.

The test plan called for the tons to be placed on tilted trays which resulted in one end of the TC being 4" higher than the opposite end. The drain tube was then inserted in the hole punched at the lower end to aid in the complete removal of rinsate generated. Three of the twenty tests were performed on flat trays which eliminated the "low end" of the TC. It is this geometry which leads to the terminology of "low end" and "high end" of the TC referred to in this report.

Figure 4.2 shows the approximate positions of the spray and drain probes where they were inserted into the TC. The actual position of the holes punched in the TC were initially 10" and 27" from the lower end of the TC. Later in the test this was changed to 11" and 28" to avoid interferences with the end bell.

A third hole was punched 15" from the upper end for installation of the VOC monitoring equipment when it was used. This upper hole was also used for spraying on a couple of occasions.

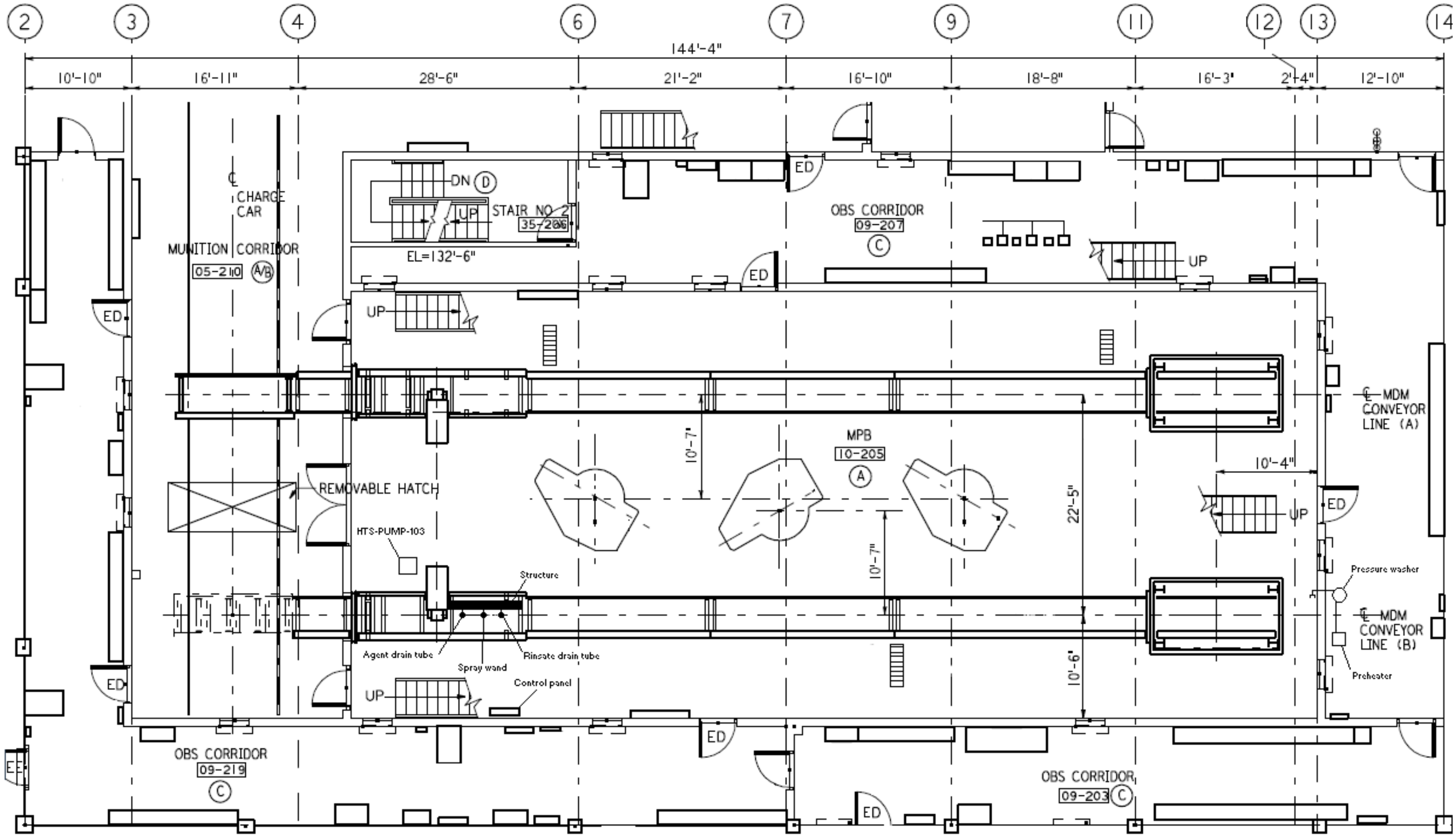


Figure 4.1. Test Assembly Configuration, MDB General Assembly

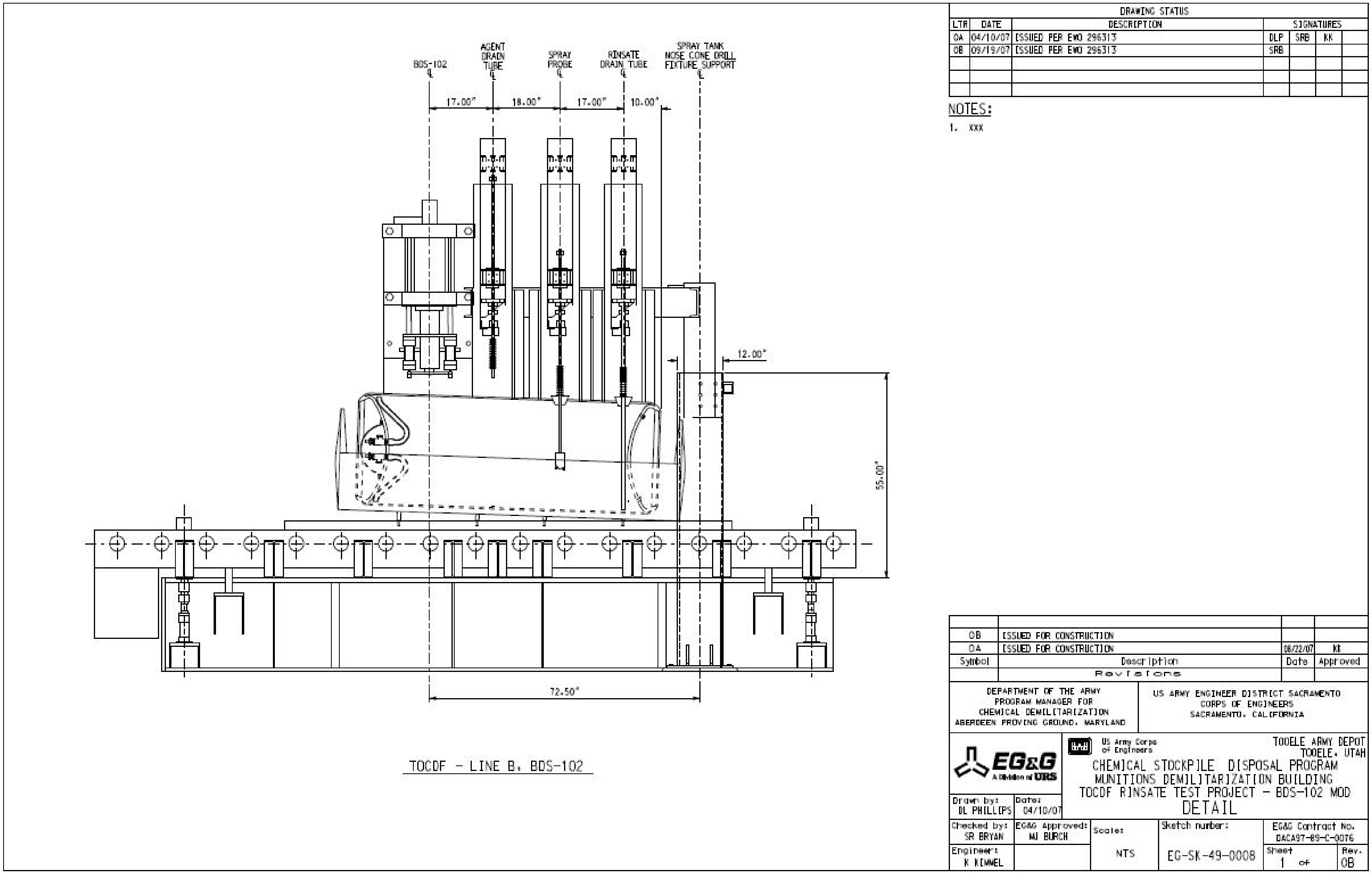


Figure 4.2. Test Assembly Configuration, BDS General Assembly

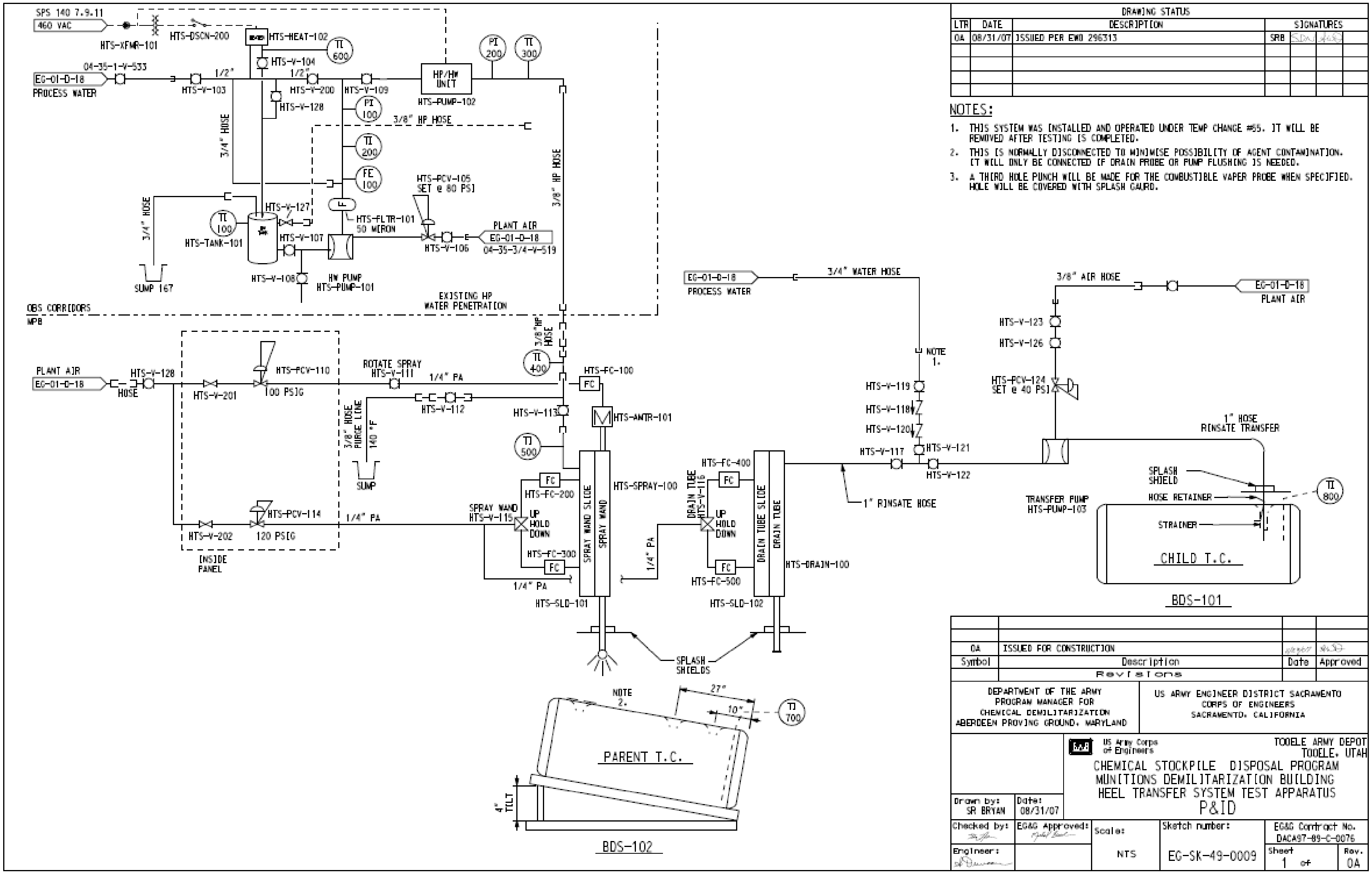


Figure 4.3. Test Assembly Configuration, P&ID

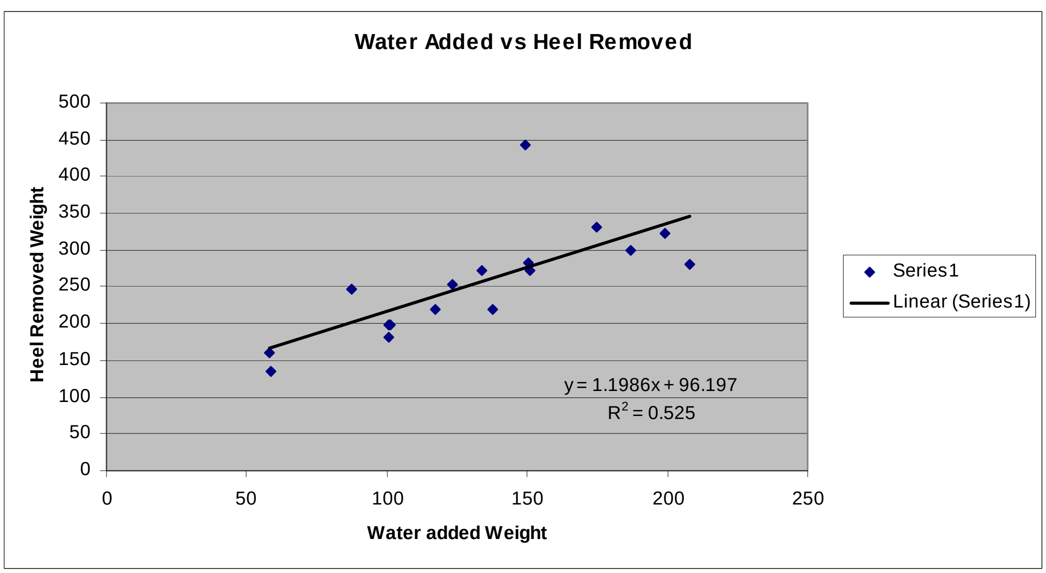
5. Results

The results of the HTS Full Scale Test have been evaluated against the test objectives delineated in Section 3. In addition to achieving the test objectives, there were numerous other lessons learned which are presented in this results section. In order to provide continuity, the explicit test objective results and the supplementary lessons learned will be discussed concurrently. Where possible, specific references to the test objectives will be provided.

5.1. Heel Removed/Water Ratio

Test objective 3.2 states that the HTS "effectiveness will largely be dependent on the quantity of water required by the process and the resultant quantity of rinsate generated by that amount of water." Similarly, test objective 3.3 states that another objective is to "determine how much heel is liquefied /mobilized to a pumpable state by varying the quantity of 120F, high pressure water spray." Both of these objectives can be evaluated by looking at the results indicating the amount of heel removed versus the amount of water sprayed into the TC (a.k.a. heel/water ratio.)

5.1.1. Summary Results – The twenty tests included TCs from 15 different lots of the stockpile in order to test the HTS on as many different heel configurations and consistencies as possible within the constraints of the logistics involved with bringing in TCs from the DCD. Five of the 15 lots selected were common to both TOCDF and UMCDF to provide cross-site utilization of the test results. The heel/water ratios obtained from the twenty tests ranged from a low of 1.3 during Test #3 to a high of 3.0 during Test #20. These results are shown on the HTS Test Data Summary Sheet in Appendix A. Overall, the average heel/water ratio obtained from the seventeen tests was 1.93, well above our minimum projected ratio of 1.0. A graph of the heel removed versus water added is shown below.



Graph 5.1

5.1.2. Minimum Spray Requirement - It was expected that the testing would result in a determination of the minimum amount of water required to remove a specified amount of heel. Early on in the test program it was learned that a minimum amount of water spray was required to liquefy the heel so it was pumpable. This is a subtle but important distinction which affects the way the system must be designed and operated.

It is also important to understand that the "spray zone" referenced below means the portion of the TC that is contacted by the conical spray emanating from the apex of the spray nozzle. The spray zone only covered about half the length of the TC with the spray wand at its maximum height inside the TC. With the heel spread more or less evenly along the longitudinal axis in the TC, approximately half of the heel was not contacted by the water spray. The spray zone was designed so that when the spray nozzle was at its maximum height inside the TC, the spray would hit halfway down the walls of the TC so heel residing on the walls of the TC would be contacted by the spray. When the spray wand was lowered into the TC, the spray zone was reduced in terms of longitudinal contact and wall contact.

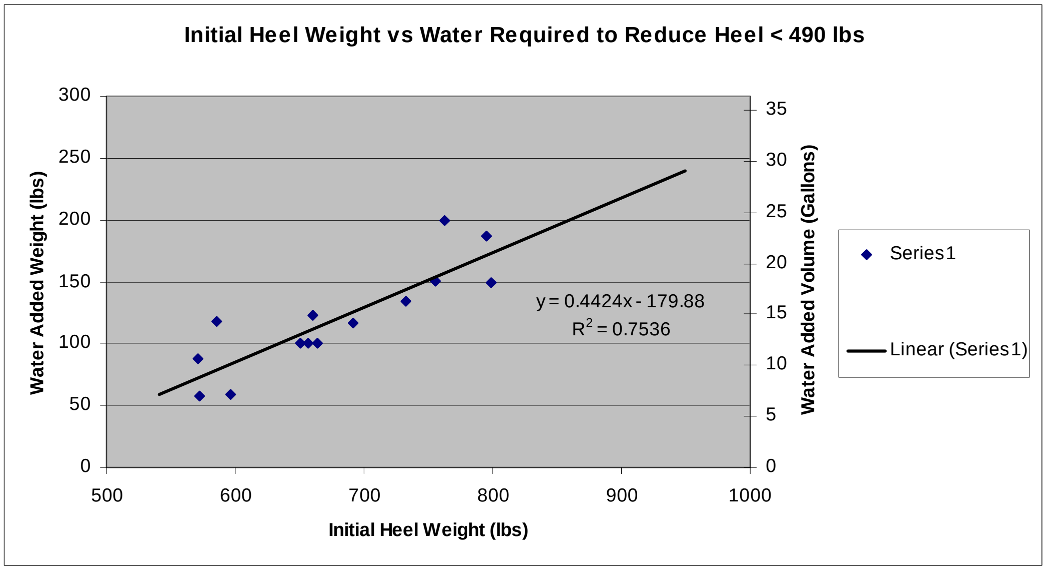
The size of the spray zone, and the amount of heel in the spray zone, dictated the minimum amount of water required to make the mass within the spray zone pumpable. It was not possible to mobilize only a portion of the mass exposed to the high pressure spray. If too little water was used, none of the heel was pumpable because the heel resembled a damp, crumbly, colloidal dispersion as opposed to a highly viscous fluid. Conversely, if the minimum, critical amount of water was used, essentially the entire heel that had been exposed to the high pressure spray became pumpable.

5.2. Water Required Versus Initial Heel Mass

Test objective 3.3 specifically states:

> It is anticipated that the more spray water that is used, the more heel will be removed up to a point of diminishing returns. It is further expected that this relationship will likely be dependent on how much heel is present to start with. Accordingly, the objective will be to determine the amount of water required to reduce the heel mass to less than 490 pounds, depending on the initial mass of heel present.

Over the course of the testing, a wide range of heel masses were encountered. Test results indicate a good correlation between the initial heel weight and the quantity of water required to reduce that weight to less than 490 pounds, as shown in Graph 5.2 below:



Graph 5.2

This data will be used as a starting point for determining the required volume of water for a specified initial heel weight when shakedown operations begin for the actual Heel Transfer System.

5.3. Soak time evaluation

5.3.1. Test objective 3.4 was to "determine whether or not "soak time" is helpful in maximizing the amount of heel removed for a given amount of hot water initially sprayed in." The test plan called for performance of some tests with a soak time and some with a simultaneous spray and drain. The rationale for the simultaneous spray and drain was that if mobile chunks of solid were present in the rinsate, they would most likely be removable by the drain tube while they were being churned around in the rinsate. They would likely settle out during a soak time and would not be removed by the drain tube unless they were in close proximity to it. Simultaneous spray and drain proved to be inappropriate for two reasons. First, as stated earlier, the rinsate mass was not pumpable at all unless a minimum volume of water was present to liquefy the heel. Assuming pumpable liquid was present near the drain tube during a simultaneous spray and drain process, it is not desired to remove this liquid since it contributes to the minimum volume required. Second, since there were no significant solids captured by the strainer at any time, the premise for the simultaneous spray and drain operation was proven false. Simultaneous spray and drain testing was discontinued after the first three tests.

5.3.2. Soak time was varied from 5 to 30 minutes. No obvious correlation could be drawn which indicated that a longer soak time was more effective at liquefying the heel. Once the minimum volume of water was sprayed in, the rinsate was immediately pumpable and no additional gains were achieved by providing a longer soak time.

5.4. Demonstration of equipment effectiveness

Test objective 3.5 was to demonstrate the operation and effectiveness of four specific pieces of HTS equipment as follows:

5.4.1. Spray Wand

The selected spray wand was the same as that utilized at ABCDF except for modifications to eliminate the 360 degree nozzle rotation and limit the spray to the bottom half of the ton container. This configuration worked extremely well and provided the coverage and heel removal efficiency required. No changes are recommended for the final design.

5.4.2. Spray Nozzle

The nozzle size was selected to provide the greatest impact force with a small amount of flow and a reasonable high pressure. Given the small volume of water used, which in turn equated to minimal "blasting" time, the nozzles proved to be very effective at breaking up the heel. Even the hardest heel encountered in Test #18 was removable with only a limited amount of spray time and yielded a heel to water ratio of 1.3. No changes are recommended for the final design.

5.4.3. Transfer Pump

The large double diaphragm pump selected for this operation performed well for all twenty tests. During the first four tests there was speculation that pump problems were occurring, but subsequent analysis and examination of the rinsate being pumped revealed that the rinsate was simply not pumpable when too small a volume of water was sprayed in due to the lack of fluidity of the rinsate mass. When the rinsate was pumpable, the pump worked perfectly. "Priming" efforts utilized in the firsts tests during troubleshooting turned out to be unnecessary and were discontinued after the first four tests.

5.4.4. Drain Tube

The drain tube design was simple. Other than the tube itself, the design consisted of a circular disc, "foot", at the bottom of the tube, and six, half-inch holes at the bottom of the tube through which the rinsate was drawn. Minimizing the number of holes and keeping the holes only on the very bottom of the tube was done to maximize inlet velocity and ensure maximum drainage from the bottom of the ton container. This design worked well with one exception when the inlet holes became blocked by the rubber sampling hose that was inserted in the TC during the Area 10 sampling process. The hose had to be manually removed from the drain tube by the DPE entrant. Final design will take this, and all other Area 10 sampling debris into account.

5.5. Video subjective analysis

Test objective 3.6 specified that video taping be performed before and after each spray and drain test in order to document the physical characteristics and distribution of the heel in the TC and determine the effectiveness of the prototype spray and drain system. This data was to be analyzed for any impact on the test results.

5.5.1. Video analysis showed a direct correlation between the heel removed and the spray zone, as mentioned earlier. In every test, the heel exposed directly to the high pressure spray was largely removed. Conversely, the heel not contacted directly by the spray, even though it may have been submerged for a period of time by some quantity of 120°F water, appeared to be unaffected. The line of demarcation of the spray zone was obvious in many cases as evidenced by a “cliff” between the remaining heel and the cleared heel in the spray zone. In other cases the transition was less pronounced due to the remaining heel cascading down and forming a gentle slope to the bottom of the cleaned out area of the ton.

5.5.2. During the course of the 20 tests, particularly when the amount of injected spray water was being limited to determine minimum water requirements, the first spray would result in portions of the heel in the spray zone remaining intact. This was particularly evident in the TC corners. This is deemed to be due simply to not using enough water and spray time. A finite amount of time is required for the water spray to blast apart and dissolve the heel. With each rotation of the spray head, a portion of the heel is apparently removed/dissolved. If insufficient time and water was allocated, the spray simply did not have a chance to “work its way down” to the remaining heel. Subsequent second sprays were successful in removing additional heel, although the heel to water ratio of the second spray was usually not as good as the first spray. This indicates that it will be more efficient to use plenty of water on the first spray rather than use two, or three, spray cycles to achieve the desired heel removal. The heel/water ratios previously discussed included the sum of all the sprays required to achieve the desired heel removal.

5.5.3. During the course of the test there were three distinct types of heel encountered.

5.5.3.1. Test #20 achieved exceptional results on the first spray which removed 444 pounds of heel from the parent. The drain was stopped early due to a full Child TC. As a result of this single spray and drain, the Parent was reduced to 355 pounds from 799 pounds and the Child rinsate weight was 621 pounds. The heel to water ratio was 3.0. The post drain video showed all of heel removed in the spray zone and even further into the opposite end of the TC than previously seen. As expected due to stopping the drain process early, considerable liquid was still present in the bottom of the TC. Upon examination with a “dip stick”, there was approximately 4” of liquid remaining on the bottom of this flat tray ton container. Based upon this level over three-fourths the length of the ton, it is estimated that another 100 pounds of pumpable rinsate remained. If this rinsate had been pumped to a second child ton container, the actual heel to water ratio would have been around 3.7.

5.5.3.2. In contrast to Test #20, Test #18 showed reduced effectiveness compared to previous tests. Although the test plan was modified by spraying 10 gallons each into both the upper and lower 28” holes before a drain was performed, it is not believed that this had any impact on the results. The third spray and drain cycle in the lower 11 inch hole failed to remove the remaining heel in the lower vicinity so that the drain tube could be lowered to the bottom. Previous results indicated a strong likelihood that this step should have been successful. Since it only removed a small amount of heel, the likely scenario is that the heel was harder to emulsify than in previous tests. The post drain video appeared to show a more solid, dark mass on the bottom of the ton.

5.5.3.3. Tests #18 and 20 were the only tests that had obvious variations in heel properties. Physical configuration affected the results of other tests such as Test #6 which achieved a heel/water ratio of 2.8. Due to the slope of the heel in the ton, the agent drain tube was unable to remove all liquid agent present. There was considerable liquid agent present along the full length of the ton in the "valley" on the opposite side of the sloping heel. Once the spray operation blasted a hole through the heel to the bottom of the TC, the rinsate drain tube was able to drain the heel dissolved in the spray zone, and the agent from the full length of the ton container. This considerable amount of liquid agent that remained in the ton after the initial agent drain step no doubt had a significant contribution to the amount of "heel" removed. In all likelihood, the higher heel/water ratio was due to geometry as opposed to chemistry.

5.5.4. It is likely that the results of some of the other 17 tests were affected by other, more subtle, combinations of chemical and physical variations in the heel. This was expected. It was also recognized that it would be impossible to parse the results in a manner that could precisely specify cause and effect for the results of every test. Taken as a whole, the HTS was able to successfully process disparate heels possessing various chemical and physical properties and provide excellent results.

5.6. Rinsate solids subjective analysis

Test objective 3.7 required a "subjective determination as to the quantity and diameter of heel "chunks" that are transferred using the process." To accomplish this, a 1/8" mesh strainer was installed at the end of the rinsate transfer hose inside the Child TC to collect any solids that were present during the transfer process. This strainer was used for the first four tests before its use was discontinued. There were only a few small particles, estimated at less than a quarter inch diameter, collected in the strainer for any of the tests. No solids were produced in the HTS process during the first four tests so use of the strainer was discontinued.

5.7. MPF Performance during Child TC Processing

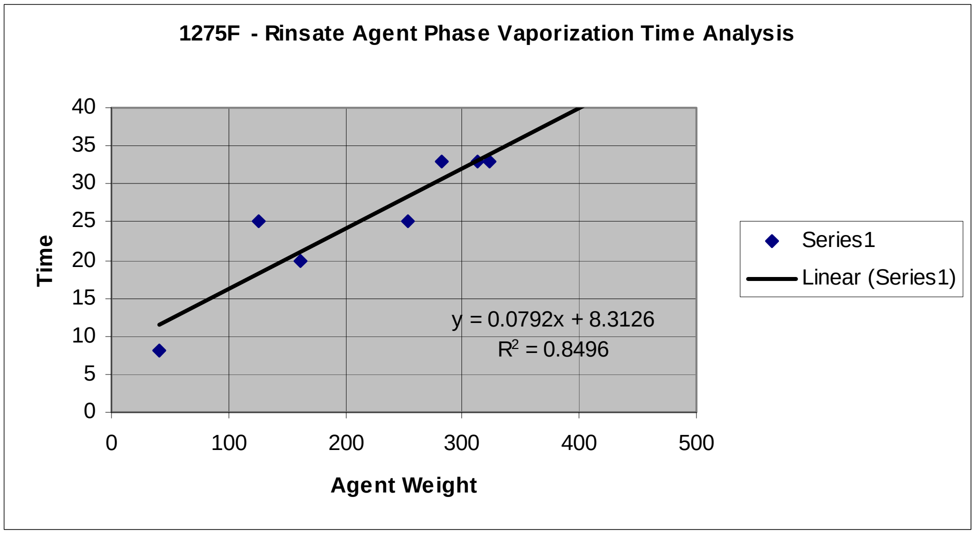
Test objective 3.8 stated to "determine the time required to process Child TCs through the MPF." This was a general objective aimed at demonstrating the performance of the MPF, given the variables that were expected including heel/water ratio and child TC rinsate weight. During the course of the testing the MPF Zone 1 temperature was varied to gather MPF performance data at multiple temperatures. This section summarizes the results and trends that were demonstrated during the MPF processing of Child TCs.

5.7.1. Child TC rinsate vaporization

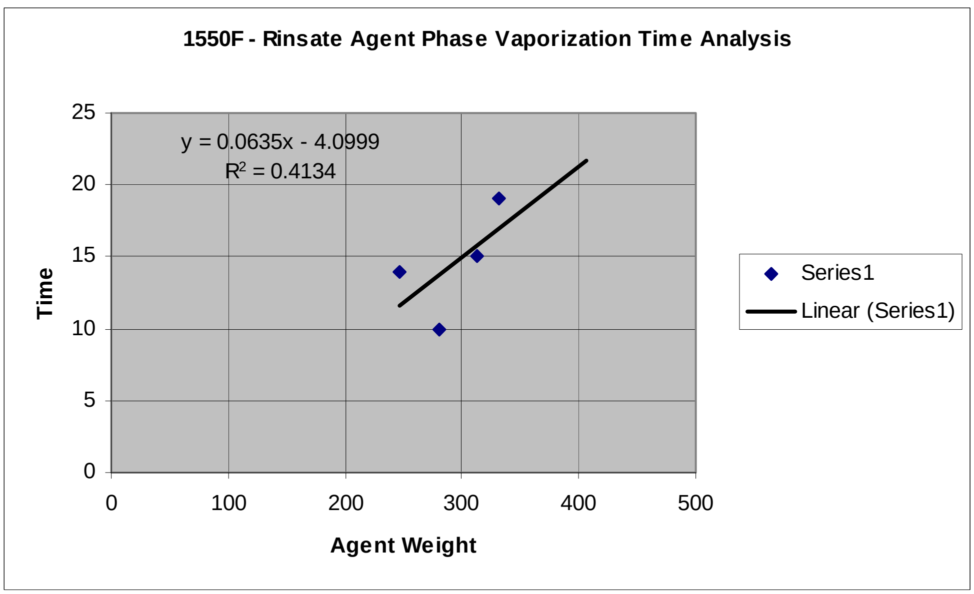
The Child TCs were processed successfully through the MPF with performance parameters well within the RCRA and MACT limitations. Although the total MPF processing time for each Child TC was different depending on the initial mass, heel/water ratio and the MPF Zone 1 temperature, they all behaved the same in one very important way. They each had two pronounced, easily distinguishable phases of vaporization. The first phase took about 80% of the processing time in Zone 1 and resulted in a constant temperature profile for the entire duration although in some cases a slow, steady temperature rise from the beginning to the end of the phase was observed. This phase has been characterized as the "water" phase and is believed to be primarily the vaporization of the water portion of the rinsate along with some small organic content. The second phase is distinguished by a sharp increase in the temperature profile of the furnace within a couple of minutes. This phase has been dubbed the "agent" phase and is characterized by vaporization rates and peaks similar to those seen while burning a standard baseline TC. For the purposes of this analysis, the time chosen for the end of the water phase and the start of the agent phase, was when the Zone 1 fuel gas reaches its minimum flow. Similarly, the end of the agent phase was defined as the completion of "substantial vaporization" as indicated by the step change that occurs when the fuel gas increases from its minimum flow.

5.7.2. Heel/water ratio

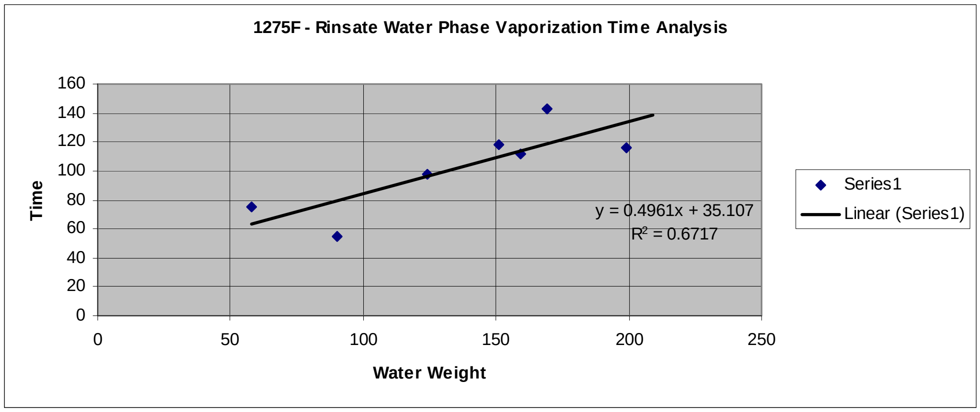
The total mass of the rinsate in a Child TC has a large impact on the time required to process the TC through Zone 1. Likewise, the heel/water ratio impacts processing time due to the longer time required to vaporize the water relative to the agent. Consequently, it is difficult to simultaneously analyze both parameters. However, as described in the previous section, because the water and agent phases are so distinct, analysis of each phase is very informative if the "water" vaporization phase is assumed to be directly proportional to, and a result of, the water mass added to each Child TC. A summary table of some MPF test parameters is shown in Appendix B. When the test data from this chart is then grouped by temperature at 1275°F and 1550°F, clear correlations become apparent as shown on the following graphs which analyze the vaporization times for the water phases and agent phases separately:



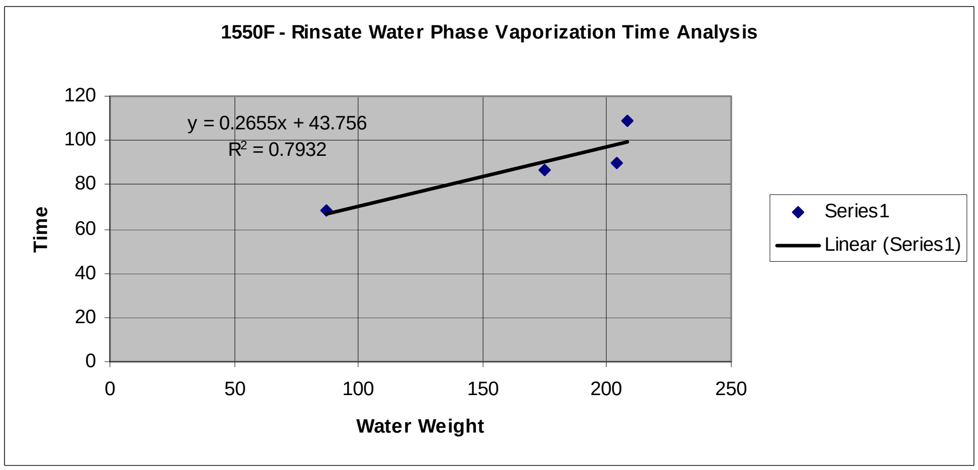
Graph – 5.3



Graph- 5.4



Graph- 5.5



Graph- 5.6

These charts provide real data for intuitive correlations. As expected, at higher temperatures, each phase undergoes more rapid vaporization.

5.7.3. MPF Child Processing of 600 pound heel

The maximum allowable rinsate weight for a Child TC is 630 pounds as prescribed by the TOCDF Operating Permit. MPF performance near this upper limit was demonstrated during tests #2, 17, and 20. Test parameters for these three tests were as follows:

Test #	Rinsate Weight (lbs)	Zone 1 Temp. (°F)	Heel/Water Ratio	Zone 1 Time (minutes)
2	609	1275	1.9	176
17	567	1350	1.7	140
20	621	1350	3.0	122

Table – 5.1

This data shows processing times that vary by 54 minutes depending upon Zone 1 operating temperature and Heel/Water ratio.

5.7.4. Test Objective 3.8.2 stated to "determine the maximum Child TC rinsate weight that can be processed through the MPF using existing MPF Zone times and Zone 1 temperature." To accomplish this objective it is necessary to apply the results of previous analysis. The water phase takes approximately 80% of the vaporization time with the agent phase taking the final 20%. Given this criteria, and assuming this analysis is for an L6 Zone 1 time of 123 minutes, the water phase would need to be complete in approximately 98 minutes. This would leave 25 minutes for the agent vaporization phase. The current Zone 1 temperature for processing TCs through the MPF is 1275°F. Applying the equation found in graph 5.5 for 1275 degree MPF processing of the rinsate water phase yields:

$$y = 0.4961x + 35.107$$

Given a water vaporization time of 98 minutes yields a water weight of:

$x = 127 lbs$ of water

Similarly, the equation found in graph 5.3 for 1275 degree MPF processing of the rinsate agent phase yields:

$$y = 0.0792x + 8.3126$$

Assuming a water vaporization time of 25 minutes yields an agent weight of:

$x = 211 lbs$ of agent

The sum of these two weights yields 338 pounds which is the approximate maximum weight that could be processed through the MPF using the current 123 minute Zone 1 time. However, the heel/water ratio calculated from these numbers is only 1.7 so there is clearly some error involved with using the equations as shown. If each equation is used independently with the assumption of a 2.0 heel/water ratio, the calculated range of rinsate mass that could be processed within the Zone 1 time of 123 minutes is 317 – 381 pounds.

Comparison of this analysis with Appendix B MPF test data shows good correlation for those tests conducted at 1275°F (i.e., Tests 1-7). Excluding Test #1 which used excessive water due to the equipment difficulties, all the data is consistent with the calculation. Specifically, Tests #2 – 4, which had a rinsate weight in excess of 381 pounds showed processing times greater than the 123 minute Zone 1 timer. Likewise, Test #5 – 7, which had weights less than 381 pounds had Zone 1 processing times less than 123 minutes. In particular, Test #5 which had a rinsate weight of 377 pounds (near the upper range limit of 381 pounds) had a Zone 1 processing time of 123 minutes.

5.8. Processing Time impact of 550 – 630 pound Parent TCs

Test objective 3.9 listed an objective to determine the processing time impact of applying the HTS process to TCs in the range of 550 – 630 pounds. That analysis is beyond the scope of this Test Report. EG&G will perform that analysis along with other analyses to optimize the overall process utilizing the HTS to handle high-heel TCs. Results of this test will be used to manage and project the cost and schedule associated with all aspects of processing high heel TCs.

5.9. Volatile Organic Compound (VOC) generation

An additional objective of this Concept Test was to validate lab data indicating that minimal or no VOCs would be produced by using 120°F water.

5.9.1. Measurement Method - During the tests, three holes were punched in the Parent TC. The spray and drain probes were inserted through two of the holes located 27" and 10" from one end of the TC. Splash shields were installed around the spray and drain probes to block the exit of spray and limit the exit of most gas and vapor. The third hole was punched 15" from the opposite end of the TC. A splash shield was installed over this hole also, but a 1" hole was left in the shield which provided an exit path for generated gases. Two VOC monitoring instruments were installed for some of the early tests at this third hole. An MSA FiveStar combustible gas monitoring device was installed on the outside of the hole with the inlet of the probe located approximately two inches from the hole. A PID VOC monitor was installed through the hole to a position approximately two inches inside the TC.

5.9.2. Results – VOC testing was not performed on all tests due to the difficulty and logistics involved with setting up the test equipment by the DPE entrants in the limited time available for the conduct of the overall test. Various problems such as dead batteries and inoperable equipment resulted in the lack of data for some tests.

The nominal hot water spray temperature was 120°F for 19 out of 20 tests performed. Process variables resulted in the temperature of the spray water varying from 120°F – 127°F. One test was conducted at 137F in an effort to determine if a higher temperature would provide better results.

Test data confirmed that the production of VOCs is either non-existent or minimal at a 120°F nominal spray temperature. Only one test (#13), during which the nominal temperature reached 127F produced any VOC readings whatsoever, a maximum reading of 5% of the LEL (LEL was 10% concentration).

In contrast to the 120°F nominal temperature results, Test #12 was conducted at 137°F in an attempt to test the effectiveness of higher temperature water. The VOC level reached 18% LEL for this test which resulted in a termination of the test. This test was completed during a second, afternoon entry with 120°F water. During the afternoon test, vapor that had previously been generated during the 137°F spray was "flushed" from the TC resulting in a maximum VOC level of 20.4% of the LEL at the exit hole of the TC.

Due to the production of VOCs during the elevated temperature test, all further tests were limited to 120°F.

5.10. Rinsate pH

To assist in the evaluation of the use of recycled TCs as Child TCs, the pH of the rinsate was obtained.

5.10.1. Method - pH of the rinsate in the Child TC was obtained on two of the early tests (#1 and #5) by using pH paper. Two different ranges of pH paper were used for each measurement. One paper, supplied by pHydrion Controls had a range of 1.4 to 2.8 (red paper). The other, supplied by Fisher Scientific, was 0.0 to 3.0 (green paper).

5.10.2. Results - Each of the tests provided similar results which verified the pH was in the range of 1.0 as expected. The green scale indicated values ranging from 0.0 to 0.5 while the red scale indicated values ranging from 1.4 to 1.7.

6. Test Issues

As with any test of preliminary/prototype systems and processes, there were problems/issues during testing that had to be resolved. The following is a summary of those encountered and the solutions implemented.

6.1. Equipment

6.1.1. Manual Operation. The HTS test apparatus was designed to emulate the proposed HTS design as much as possible except that it was a completely manual operation controlled locally by DPE entrants with assistance from test team members on an as needed basis (HPHW System Operation), as opposed to an automated system controlled from the CON. The equipment performed well once some initial technical issues were solved.

The equipment problems encountered in the first two tests made test execution and data acquisition difficult and therefore results were somewhat questionable. Confidence in the data acquired for the last 18 tests, however, is high.

6.1.2. Splash Protection Devices. The magnetic shields utilized to cover the spray and drain holes was highly effective in eliminating/reducing spray from the TC during pre-test operations in the BRA. During actual testing, however, the magnetic material proved to be too brittle for the application and failed under repeated flexing. This failure caused the collar holding the shield to drop and jam the drain tube against the punched hole in the TC, stopping operations.

The problem was initially solved by removing the collar and manually placing the magnetic shields around the tubes after they were inserted in the holes.

Redesigned automatic shields were later installed using a heavy duty rubber material. The new shields proved to be as effective as the original magnetic shields but were very durable and performed well.

6.1.3. BDS Load Cell Drift.

Four load cells, built into the conveyor supports, constantly sense the weight supported by the conveyor when it is raised. Data from the four load cells is processed to provide the Control Room (CON) with one weight indication. These cells are used with the conveyor in the raised position to measure the weight of the ton containers before and after they are drained.

For test analysis data the BDS load cells on BDS 102 were used to measure/calculate both the amount of water added and the heel removed in the process.

During the first two tests the elapsed time between the first and second DPE entries resulted in delays recording weight data. During this time it was discovered the load cell readings had drifted (decreased) which resulted in data discrepancies. This "drift" was not due to any fault in the load cells; rather, it was the result of the lift cylinders bleeding off hydraulic pressure which resulted in the load cells not being subjected to the full weight of the conveyor. The problem was corrected in subsequent tests by raising and lowering (loading and unloading the load cells) before weight data was recorded. Because of this problem the data gathered for the first two tests was excluded from aggregate calculations.

6.1.4. Lift Cylinder Failure. The BDS load cell readings led to an investigation of the lift cylinders themselves on both BDS 101 and 102.

At the conclusion of Test #5 the lift cylinders were inspected. It was discovered that the NE lift cylinder on BDS 102 (Parent TC) had sheared off.

The cylinder was replaced prior to the start of Test #6. Prior to the replacement of the lift cylinder, variations in load cell readings were mitigated by cycling the conveyor two or three times to ensure consistent readings were obtained. This problem may have contributed to some error in the load cell readings for Tests 1 through 5, but this was mitigated as described.

6.1.5. Drain Tube Plugging. During Test #13 the drain tube became plugged by the rubber hose which gets pushed into the TC during Area 10 sampling operations. The rubber hose was wrapped around the drain tube effectively plugging all six inlet holes at the base of the tube. A DPE entrant had to physically unwrap the hose from around the drain tube to make it functional.

6.2. Procedural Issues

6.2.1. A formal procedure was created for the testing. Because of the nature of the test itself however, some details of the procedure had to be modified for each test. The differences were annotated on the test data sheets, as necessary. The procedural changes had no effect on the data collected.

6.2.2. One procedural change was brought about because it was noted that the weight measurement for both the parent and child lines tended to "drift" over a period of time. Removing and reapplying the weight by raising and lowering the conveyor corrected the drift. This change was implemented with Test #3 which then made the procedure consistent with normal practices used for processing baseline TCs.

6.3. Data Issues.

The variable load cell data described in the previous paragraphs gave rise to a concern over disparity in calculations related to the heel removed from the Parent TC.

6.3.1. It was recognized during the planning of the HTS testing that problems would likely be encountered if calculations were made and compared using data derived from both BDS-101 and BDS-102 because of differences in load cells.

To avoid problems associated with these differences and proceduralized agent tracking documentation, all test calculations relating to such documentation was performed using only the Parent TC load cell (BDS 102).

6.3.2. By design, the load cells are +/- 0.1% of full span, yielding an uncertainty of +/- 20 pounds. The load cells are not designed for the small measurements required for analytical test data (i.e., a +/- 20 pound difference on a 10k pound TC (with agent, cradle and tray) has much less impact than a +/- 20 pound difference on a 100 pound water spray parameter.) The test apparatus included the use of a water flowmeter with a 2% accuracy. This flowmeter provided a very accurate method of determining how much water was added to the Parent TC during the spray process. The flow meter was deemed to be more accurate than the method utilized in the procedure which derived the water added by performing a calculation using load cell data. To make data analysis as accurate as possible, all HTS data analysis utilizes water data taken directly from the flow meter. This creates some confusion when looking at the HTS Summary spreadsheet that the reader must be aware of. Specific calculations used for analysis are:

6.3.2.1. *Weight of water added during spray operation* - Calculated by multiplying the number of gallons added, as indicated by the flowmeter, times the density of water (8.25 lbs/gal).

6.3.2.2. *Weight of heel removed from the Parent TC* - Calculated by taking the difference between the initial Parent TC weight and the post rinsate drain weight of the TC.

6.3.2.3. *Rinsate weight transferred to the Child TC* - Calculated by taking the difference between the Post Spray parent weight and the Post Drain Parent weight.

7. Post Test Inspections & Disposal

7.1. Child TC Integrity

7.1.1. Background:

Using water to liquefy solid heel for transfer to child ton containers results in the generation of hydrochloric acid. Because hydrochloric acid is corrosive to the materials used to fabricate ton containers (mild steel, stainless steel, and brass), there was some concern that leaks may develop in the child ton containers. Because of this potential for leaks, a test was needed to determine gross corrosion rates.

7.1.2. Test Set-up

A series of locations were physically marked using a chisel on a processed ton container that had been designated for use as a child ton container (see figure 7.1). Prior to being used, thicknesses were taken at each marked location. Thicknesses were taken by the Quality Department using an ultrasonic measuring device.

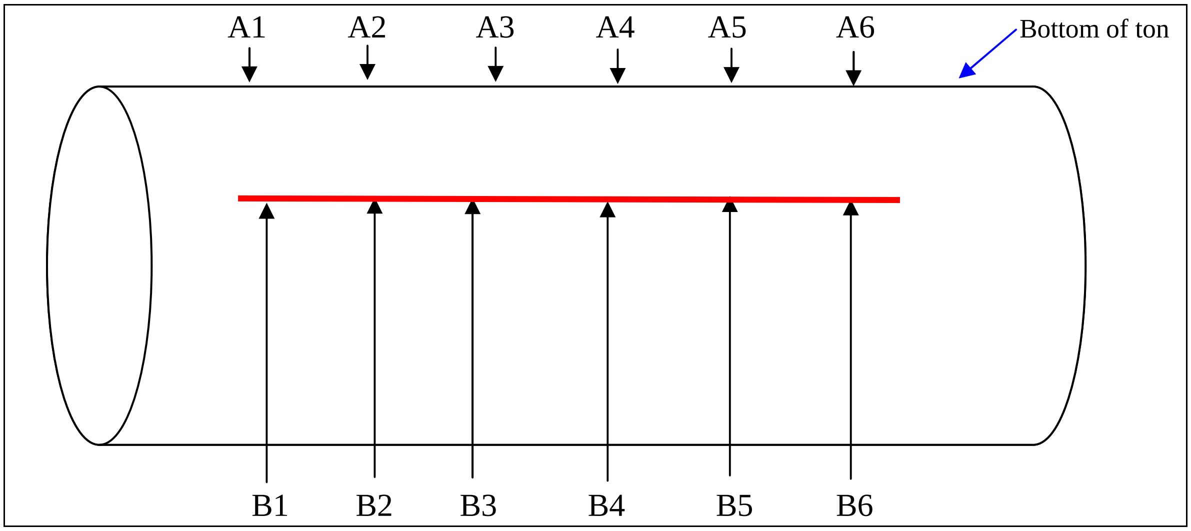


Figure- 7.1 Ton Container Sampling Locations

7.1.3. UT Test Execution

The measured ton container was used twice for heel transfer. Between the two tests and at the conclusion of the second test, thickness measurements were taken at the marked locations. Having the thickness measurements and knowing the time that the ton container was exposed to the corrosive liquid, corrosion rates were calculated. Thickness measurements, contact times, and calculated corrosion rates are shown in Appendix C.

7.1.4. Results

The results of the test indicate that the average corrosion rate of a ton container used for heel transfer is 0.00415 inches per day. The test was conducted along the bottom and side of the ton container. This is the thinnest part of the container. The ends are fabricated from thicker material (see Figure – 7.2).

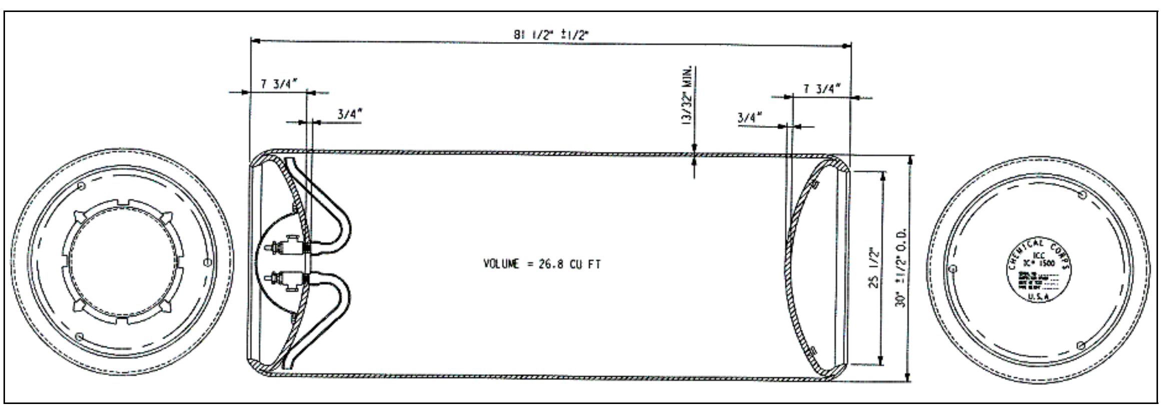


Figure – 7.2 Ton Container Dimensions

Based on this test the corrosion rates of child ton containers used for heel transfer is not excessive and are approximately the same as was anticipated prior to the test.

7.2. Materials Inspection

Dismantlement of the HTS test apparatus included a thorough examination of all parts exposed to the rinsate and the high pressure spray. This included dismantlement of the rinsate pump to look at internal parts. No noticeable wear or corrosion was observed on any of the equipment. As a result, no explicit changes in materials of construction are recommended.

7.3. Equipment Disposal

Planning for this test included plans for disposal of all test equipment by processing through the MPF in lieu of any attempted decontamination operations. As of this writing, with dismantlement and disposal nearing completion, no issues have been encountered with processing the equipment through the MPF.

8. Design Recommendations

Recommendations for the final design and operation of the HTS are as follows:

8.1. Equipment

8.1.1. Rinsate Transfer Pump – The diaphragm pump specified for the test worked well both in terms of performance and materials. However, because no significant solids were discovered in the rinsate strainer, the ½” internal clearances provided by this large pump are not required. Due to the limited space available in the MPB, a smaller size of the same line of pumps is recommended. Care should be taken to ensure the dry suction lift specification of the new pump meets or exceeds that of the tested pump. The drain tube has holes sized at ½” that previously served to protect the pump. A strainer will need to be added to provide pump protection against foreign objects being sucked into the pump with a diameter greater than the new pump is designed for but less than the ½” drain tube holes.

8.1.2. Spray Wand – As stated earlier, the spray wand performed as designed for this test. Since this spray wand is virtually identical to the one use at ABCDF, which performed well for their application, no changes are recommended for this component.

8.1.3. Spray Nozzles – No changes recommended as stated earlier.

8.1.4. Drain Tube – The drain tube worked well except for Test #13 during which the drain tube became plugged with the rubber hose from Area 10. It is recommended that the clogging problem be solved by punching and draining the TCs at the opposite end, away from the Area 10 debris. If this is not feasible, some sort of ribbing, or stand-off mechanism will be required on the end of the drain tube to keep the rubber tube from wrapping around it.

8.1.5. Piping – PTFE material was utilized for the rinsate drain hoses for this test and they performed well with no perceivable degradation. In addition, the Hastelloy fittings and valves used showed no signs of deterioration. Both materials are recommended for final design components. To simplify installation, consideration should be given to the continued use of heavy duty, PTFE hoses rather than hard pipe which would required more work to install.

8.1.6. Child TCs – The use of recycled TCs as Child TCs was limited to one cycle during the test except for one TC that was used twice for the purposes of analysis as described earlier. This conservatism was due to lack of data and concerns that corrosion could possibly be severe. Testing showed that corrosion was limited. Consideration should be given in the final design to continuing to utilize recycled TCs.

9. HTS Operations Optimization

Performance of the HTS testing successfully demonstrated the process concept and provided data indicating the minimum level of performance that can be expected from the operation of the final system. Test execution and data analysis has also identified opportunities for process optimization. Some of those opportunities are delineated in this section.

9.1. Spray and Drain Optimization

9.1.1. Spray Zone Control

9.1.1.1. Section 5.1.2 identified the relationship between the spray zone and the heel removed. For a given mass of heel present in the spray zone, a minimum amount of water was required, regardless of the amount of heel that was desired to be removed. If the minimum amount of water was not used, the entire rinsate mass, including the water sprayed in, became a damp, colloidal mass that was not pumpable, except for a minimal amount in some cases. Once the minimum amount was used however, the entire mass contacted by the water spray became pumpable.

9.1.1.2. The minimum water scenario described above led to early concerns that it may be necessary to remove more heel than required in order to reduce the heel below the 490 pound, L4 upper limit. In other words, because the spray zone resulted in water contact with too much heel, the minimum water requirement might result in the liquefication of too much heel. As a result, we might have been forced to overshoot the goal and take out more heel than desired. This would have created an excessive amount of rinsate which would impact the processing schedule. Two solutions were provided for this scenario as follows:

9.1.1.2.1. Although the test criterion called for removal of all pumpable rinsate, this criterion may not be applicable to the operation of the permanent system. The rinsate could be pumped down to achieve the desired remaining heel mass and then stopped with the remaining pumpable rinsate left in the Parent TC. Since this scenario is most likely applicable only to TCs in the range of about 550 – 600 pounds where the mass of heel in the spray zone is at a minimum, this method should leave a relatively small amount of water in the Parent TC which will not affect the Parent processing time.

9.1.1.2.2. The second, and preferred method of controlling the amount of rinsate generated, is to control the size of the spray zone. Test #17 tested this theory by spraying into the lower 11" punch hole which was normally the drain hole. In addition, the spray wand stroke was modified by limiting the height to which the wand was operated. These two activities limited the amount of heel that was contacted by the spray pattern thus minimizing the “sponge” effect of the heel and maximizing the effect of the water that was sprayed in. This experiment appeared to be effective although Test #6 provided similar results without utilizing either of the spray zone limiting tactics. Due to the 2.8 heel/water ratio of Test #6, it is suspected that the heel in that test was more soluble than the average heel. Additional testing during future shakedown operations will be performed to confirm and refine the spray zone limiting technique.

9.1.2. Spray Wand Stroke time and Zone Control

The scenario described in the previous paragraph was an example of limiting the spray zone so as to minimize the amount of heel contacted and ultimately removed. Testing indicated that the converse may be beneficial also. If a very high heel ton is encountered which requires the removal of a significant amount of heel, it may be more efficient to have the spray wand spend more time at the upper end of the stroke so that the spray reaches out farther into the ton and contacts more heel in the process. This concept was experimented with during tests 10 and 11 with inconsistent results. Other variables, such as heel consistency have a big impact on the results so no conclusions can be drawn about this technique. It will be analyzed further however and investigated fully during HTS shakedown operations as a possible means of optimizing the process.

9.1.3. Spray Volume

Section 5.2 identified a good correlation between the initial heel weight and the quantity of water required to reduce that weight to less than 490 pounds, as shown in Graph 5.2. This correlation is closely tied to the heel/water ratio but is still dependent on other factors. One of those factors may be the spray volume of the first spray.

The water weight shown in the Graph 5.2 was the sum of all the water sprayed into the TC. In some cases this consisted of one spray but in others it was two sprays. When two (or more) sprays are used to reduce the heel to less than 490 pounds, the draining operation at the end of the first spray results in the removal of liquid which may be contributing to the minimum volume required to mobilize all of the heel contacted by the spray. A portion of that second spray volume may simply be replacing the water that was sprayed in and pumped out again at the end of the first spray and drain cycle. If such is the case, and the frequency of second or third sprays is significant, it might be more efficient overall to use excess water on the first spray in order to minimize the number of second sprays required. This test project did not have enough trials available (limited to 20 in accordance with the Permit variance) to answer this question but it will be fully investigated during shakedown operations for the final HTS.

9.1.4. Heel Drain Time

Section 5.3.2 drew the conclusion that shorter duration soak times on the order of 30 minutes and less did not provide any quantifiable advantage. During the course of the testing, several tests required two entries to fully execute the test and achieve the objectives for those particular tests. This would occur when the drain operation that took place at the end of the first entry was unsuccessful in removing the required amount of heel thus requiring a second spray that would then be conducted on the second entry. It was observed that at the beginning of the second entry, despite being fully drained on the first entry, there would be a small amount of rinsate collected in the ton that could be drained out without any further spraying operations. This liquid is likely due to agent and/or water draining out of the remaining heel mass and collecting in the void left by the removed heel mass. Since the time available for the HTS spray and drain operation is significantly shorter relative to the time required by the MPF TC operations, it may be possible to let the Parent TC sit for a period of time to allow additional agent/water to drain out of the heel. This additional rinsate drainage could then be pumped out without the performance of second (or third) spray operation. This scenario could be taken advantage of when only a small mass of heel remains to be removed in order to achieve an L4 classification. This would help to minimize the quantity of rinsate generated thus improving production efficiency. This will be investigated further during HTS shakedown operations.

9.2. MPF Optimization

9.2.1. Child TC Rinsate Mass

Section 5.7.3 provided data indicating the processing times for Child TCs containing rinsate masses in the 600 pound range. Similarly section 5.7.4 determined that rinsate masses would need to be limited to a range of about 320 – 380 pounds using current MPF operating parameters. Although it is beyond the scope of this test report to perform a full optimization study for processing Child TCs through the MPF, it is being proffered that the most expeditious means of processing rinsate will be to use Child TC rinsate weights on the order of 600 pounds and hold them in the furnace for a longer period of time than is currently done for baseline mustard TCs. This will be evaluated further in the development of an MPF optimization plan.

9.2.2. Zone 1 Temperature

Looking again at the Graphs 5.1 – 5.4, optimization may be possible by developing ways to process the water and agent phases with different parameters. The following table shows the vaporization times for the different phases at different temperatures as taken from Graphs 5.1 through 5.4 for a Child TC with 600 pounds of rinsate and a 2.0 heel/water ratio:

Temp	Water (200 lbs) (minutes)	Agent (400 lbs) (minutes)	TOTAL (minutes)	Delta (minutes)
1275°F	134	40	174	
1550°F	97	22	119	55
1550/1275°F	97	40	137	37

Table– 9.1

The 1275°F data indicates the MPF performance if no optimization is performed. The 1550°F data shows what the results would be if the MPF could be operated at that temperature. However, there are limiting MPF parameters that will likely prevent the operation of the MPF at that temperature during the agent phase so it is unlikely that level of performance will be possible. The last 1550/1275 line in the table provides an indication as to possible performance optimization that might be achieved if the water phase is conducted at 1550°F followed by 1275°F for the agent phase.

Utilizing two different temperatures for processing the two phases of the Child TC may be problematic in terms of MPF operation. If this turns out to be the case, the single temperature chosen for Child TC processing will likely be established as high as possible while still providing appropriate safety margins to ensure upper temperature limits are not exceeded in the MPF. Considerable analysis will be required before any course of action is decided on.

Appendix A - HTS Test Data Summary

Appendix A - HTS Spray and Drain Test Data Summary

Test #	Test Date	D#	Lot #	Initial Heel	Spray Temp	Test Type	1st spray volume (gal.)	1st drain heel removed (lbs)	1st spray pumpable	2nd spray volume (gals)	2nd spray location	2nd drain heel removed	3rd spray volume (gals)	3rd drain heel removed	4th spray volume (gals)	4th drain heel removed	Water weight from priming	Total Water mass	Total Heel Removed	Heel to Water Ratio	Final Parent Heel Weight	Heel Distribution	Child Rinsate Weight	Comments
1	8-Oct	79754	316	557	122	Simultaneous	10.5		No	5.1	27"						30	159	126	0.8	431		366	Pump and shield problems
2	9-Oct	94917	380	922	124	Simultaneous	10.24		No	10.21	27"							169	313	1.9	609		609	Pump and shield problems
3	10-Oct	78719	368	763	126	Simultaneous	10.25	124	Problems	10.23	15"	189					30	199	323	1.6	440	Even - 45^o slope	501	Second drain was performed in the upper (opposite end) 15" hole.
4	11-Oct	78735	368	755	127	30 minute soak	10.26	83	Problems	6.18	27"	200					15	151	283	1.9	482	Even - 45^o slope	486	Prime after 1st pump attempt
5	12-Oct	17759	283	660	122	30 minute soak	14.97	253	Yes	0	n/a	0					0	124	253	2.0	407	Even - No slope	378	
6	13-Oct	14171	283	572	123	30 minute soak	7.03	161	Yes	0	n/a	0					0	58	161	2.8	411	Even - 45^o slope	235	
7	14-Oct	36831	357	604	122	30 minute soak	7.25	41	No	0	n/a	0					30	90	41	0.5	563		111	This data point can't be directly compared to the others since a second agent drain was performed which removed 113 pounds of agent. Two "primes" were performed. No time for second spray.
8	15-Oct	85695	357	664	124	30 minute soak	12.23	182	Yes	0	n/a	0					0	101	182	1.8	482	Even - 30^o slope	326	
9	16-Oct	82730	359	755	124	30 minute soak	14.14	204	Yes	4.16	27"	52					0	151	273	1.8	482	Even - 30^o slope	434	
10	17-Oct	17288	283	733	124	30 minute soak	16.23	273	Yes	0	n/a	0					0	134	273	2.0	460	Even - 30^o slope	421	Spray wand was maintained at top of travel for longer time. Spray wand hung up 8" from bottom of travel preventing downward travel for about a minute.
11	18-Oct	32252	(UMA) 313	795	124	30 minute soak	16.2	231	Yes	4.22	27"	63	2.24	12			0	187	299	1.6	489	Even - 30^o slope	507	Three sprays. Second spray heel removed includes 15 pounds that was drained at the beginning of the second entry.
12	19-Oct	82461	380	730	137	30 minute soak	8.44	0	No	8.25	27"	219					0	138	219	1.6	511	Even - No slope	382	FLAT TRAY. 137F spray. VOCs caused test halt. First spray ended up with 3 hour soak. Second spray at 123F with 15 minute soak.
13	20-Oct	81158	(UMA) 350	651	126	30 minute soak	12.21	199	Problems	0	n/a	0					0	101	199	2.0	452	Even - No slope	312	First spray was pumpable except for the drain tube getting plugged by the rubber hose.
14	21-Oct	43499	(UMA) 372	657	108	30 minute soak	12.24	100	Problems	0	n/a						0	101	198	2.0	459		323	164 pounds of rinsate transferred on first pump attempt. Heel amount is estimated for first attempt.
15	22-Oct	7107	(UMA) 303	571	122	20 minute soak	6.22	0	Problems	2.17	27"	20	2.19	227			0	87	247	2.8	324	Even - 10^o slope	364	First 6 gallon spray was ineffective in making a pumpable slurry. 2nd 2 gallon spray had marginal effectiveness and only removed about 20 pounds. Third 2 gallon spray removed significant heel. No soak time on second and third sprays.
16	23-Oct	92896	264	691	125	15 minute soak	14.12	205	Yes	7.08	Middle	118		9			0	175	332	1.9	359	Even - 45^o slope	524	FLAT TRAY. 1st spray was in end hole that was at about 25" position. 2nd spray was in a hole near the middle of the ton. 2nd drain used 3 minute soak time. Both sprays resulted in same heel/water ratio. Nine additional pounds were drained without a spray at the beginning of the 2nd entry.
17	24-Oct	81352	(UMA) 373	596	121	5 minute soak	7.13	134	Yes	7.12	28"	95	7.07	89	4.07	39	0	209	357	1.7	239	Even - 15^o slope	567	Limiting excessive heel removal was objective of first spray. First spray in 11" hole and spray stroke limited to 16" maximum retraction. First spray ratio 2.2. Other sprays were for generating heavy child. 2nd spray in 28" middle hole. 3rd & 4th sprays in high end 28" hole.
18	25-Oct	17830	289	545	124	15 minute soak	10.04		Yes	10.07	28"	230	5.12	50			0	208	280	1.3	265	Even - No slope	522	First spray with NO drain in upper 28" hole. Second spray in lower 28" hole followed by FIRST drain. Video result showed heel remaining. Different type of heel likely.
19	26-Oct	52455	322	585	122	15 minute soak	10.16	0	No	4.08	28"	219	10.43	94			0	204	313	1.5	272	Even - No slope	513	Ratio after 2nd S&D = 1.8. Third S&D through upper 28" hole was solely to generate rinsate for child.
20	27-Oct	10679	285	799	124	15 minute soak	18.07	444	Yes	0	n/a	0					0	149	444	3.0	355	Flat then 45^o slope	621	FLAT TRAY. Spray zone completely clean. Different type of heel likely.
Total																		**2565**	**4677**	**1.8**				

Appendix A - HTS Spray and Drain Test Data Summary (continued)

	Qualified data used for aggregate heel/water ratio analysis				Qualified data for initial heel mass versus water required analysis		
Test #	Total Water Weight	Total Heel Removed	Heel to Water Ratio	Child Rinsate Weight (water calculated from flow meter)	Initial Heel	Water Weight (pounds)	Water Volume (gallons)
1				285			
2				482			
3	199	323	1.6	522	763	199	24.1
4	151	283	1.9	434	755	151	18.3
5	124	253	2.0	377	660	124	15.0
6	58	161	2.8	219	572	58	7.0
7				131			
8	101	182	1.8	283	664	101	12.2
9	151	273	1.8	424	755	151	18.3
10	134	273	2.0	407	733	134	16.2
11	187	299	1.6	486	795	187	22.7
12	138	219	1.6	357			0.0
13	101	199	2.0	300	651	101	12.2
14	101	198	2.0	299	657	101	12.2
15	87	247	2.8	334	571	87	10.6
16	175	332	1.9	507	691	116	14.1
17	59	134	2.3	566	596	59	7.1
18	208	280	1.3	488			0.0
19	117	219	1.9	517	585	117	14.2
20	149	444	3.0	593	799	149	18.1
	2239	**4319**	**1.93**				

Appendix B - MPF Child TC Test Data Summary

Test #	C#	Water Weight	Agent Weight	Total Rinsate Weight	Ratio	Zone 1 Temp	Start Time	Water time TIT-065 start to rise	Agent time to TI-065 peak	Agent Time to Fuel Minimum FIC-209	Agent Time to Fuel Increase FIC-209	Agent Burn Time (Fuel off to fuel on)	Comments
1	79754	159	126	285	0.8	1275	16:01	112	117	112	137	25	
2	94917	169	313	482	1.9	1275	6:43	143	153	143	176	33	
3	78719	199	323	522	1.6	1275	16:34	116	126	117	150	33	
4	78735	151	283	434	1.9	1275	7:55	118	125	117	150	33	
5	17759	124	253	377	2.0	1275	23:20	98	105	98	123	25	
6	14171	58	161	219	2.8	1275	19:11	75	79	75	95	20	
7	36831	90	41	131	0.5	1275	16:30	55	57	57	65	8	
8	85695	101	182	283	1.8	1450-1275	7:55	80	87	81	103	22	
9	82730	151	273	424	1.8	1450-1275	10:18	99	105	97	123	26	
10	17288	134	273	407	2.0	1550-1275	13:08	87	93	87	112	25	
11	32252	187	299	486	1.6	1350	13:09	120	128	121	149	28	209 cycles
12	82461	138	219	357	1.6	1350	17:25	96	102	97	113	16	
13	81158	101	199	300	2.0	1350-1450	20:16	77	80			0	209 unusable due to cycling
14	43499	101	198	299	2.0	1450	16:46	63	68	65	80	15	
15	7107	87	247	334	2.8	1550	16:58	68	74	68	82	14	
16	92896	175	332	507	1.9	1550	17:11	87	93	87	106	19	
17	81352	209	357	566	1.7	1350	18:45	111	120	112	140	28	
18	17830	208	280	488	1.3	1500	21:44	109	115	111	121	10	
19	52455	204	313	517	1.5	1550	20:15	90	97	91	106	15	
20	10679	149	444	593	3.0	1350	10:15	96	104	96	122	26	

Appendix C - Child TC Corrosion Data

Test One							
	A 1	A 2	A 3	A 4	A 5	A 6	**Average**
Initial Measurements	0.489	0.493	0.498	0.494	0.488	0.486	0.491
After first test	0.483	0.492	0.487	0.484	0.486	0.483	0.486
Difference	-0.006	-0.001	-0.011	-0.01	-0.002	-0.003	**-0.006**
	B 1	B 2	B 3	B 4	B 5	B 6	**Average**
Initial Measurements	0.484	0.486	0.491	0.489	0.483	0.476	0.485
After first test	0.467	0.475	0.484	0.487	0.483	0.480	0.479
Difference	-0.017	-0.011	-0.007	-0.002	0	0.004	**-0.006**
Contact Time	**1.48**	**Days**	**35:38**	**Hours**			
Avg Corrosion Rate			**St Dev**				
A series	0.0037	Inches per day	0.0042				
B Series	0.0037	Inches per day	0.0077				

Test Two							
	A 1	A 2	A 3	A 4	A 5	A 6	**Average**
Initial Measurements	0.483	0.492	0.487	0.484	0.486	0.483	0.486
After Second Test	0.465	0.475	0.486	0.477	0.479	0.472	0.476
Difference	-0.018	-0.017	-0.001	-0.007	-0.007	-0.011	**-0.010**
	B 1	B 2	B 3	B 4	B 5	B 6	**Average**
Initial Measurements	0.467	0.475	0.484	0.487	0.483	0.480	0.479
After Second Test	0.464	0.466	0.47	0.468	0.461	0.451	0.463
Difference	-0.003	-0.009	-0.014	-0.019	-0.022	-0.029	**-0.016**
Contact Time	**3.00**	**Days**	**71:58**	**Hours**			
Avg Corrosion Rate			**St Dev**				
A series	0.0034	Inches per day	0.0065				
B Series	0.0053	Inches per day	0.0093				

Total of Both Tests							
	A 1	A 2	A 3	A 4	A 5	A 6	**Average**
Initial Measurements	0.489	0.493	0.498	0.494	0.488	0.486	0.491
After tests	0.465	0.475	0.486	0.477	0.479	0.472	0.476
Difference	-0.024	-0.018	-0.012	-0.017	-0.009	-0.014	**-0.016**
	B 1	B 2	B 3	B 4	B 5	B 6	**Average**
Initial Measurements	0.484	0.486	0.491	0.489	0.483	0.476	0.485
After tests	0.464	0.466	0.47	0.468	0.461	0.451	0.463
Difference	-0.02	-0.02	-0.021	-0.021	-0.022	-0.025	**-0.022**
Contact Time	**4.48**	**Days**	**107:36**	**Hours**			
Avg Corrosion Rate			**St Dev**				
A series	0.0035	Inches per day	0.0052				
B Series	0.0048	Inches per day	0.0019				

Appendix D - HTS Test Daily Summaries

Note: Daily summaries were not prepared for tests 1 and 2.

HRS Test #3 Summary Report

October 10, 2007
Ton D# - 78719
Initial Heel Weight (after agent drain) – 763 pounds
Planned Spray – 10 gallons
Planned Sequence – Simultaneous Spray and Drain

The inability to pump rinsate was analyzed and it was determined that there are two possible causes. First, there was insufficient dry suction lift for the rinsate generated. To test this the test sequence was modified such that a "priming" step was performed at the beginning of the test by filling the rinsate suction drain hose with process water up to the high point in the line. With the rinsate hose filled the wet suction lift pump specification is applicable which is more than enough to ensure the liquid can be pumped. After the suction drain hose was filled the test was executed as written. Another possible reason for the pump not pumping is that the water added was not sufficient to successfully fluidize the heal matrix thus leaving the heel too thick to pump.

The test was planned as a simultaneous spray and drain test with a spray volume of 10 gallons at 120F. The initial plan was to spray for approximately two minutes and then lower the drain tube and start the rinsate transfer pump. Since there is no flow measurement capability in the rinsate transfer line, it is difficult to ensure that a flow rate was established that was low enough such that it would not deplete the available rinsate, thus losing the prime previously established in the line. As a result the test director modified the plan slightly such that the drain was not started until nine gallons of water had been sprayed in. This resulted in one minute of simultaneous spray and drain.

The video of the inside of the parent ton showed that the heel was spread fairly evenly along the ton. However, it was sloped up one side and was distributed as if the bottom of the ton was at approximately the 135 degree point with zero degrees being the top.

Upon execution of the plan, approximately 100 pounds of rinsate was transferred until the pump stopped pumping. At this point an additional priming operation took place which resulted in the addition of 15 pounds of water to the parent ton. The rinsate pump was once again started which resulted in the transfer of additional rinsate. The total amount of rinsate transferred as a result of the first 10 gallon spray was 237 pounds, of which approximately 124 pounds was heel and 113 pounds was water. (Water = 83 + 30 (2 primes at 15 pounds each). This concluded the first DPE entry.

The second entry began with a video examination of the first spray and drain results. The video indicated that a majority of the heel in the lower end of the ton had been removed although a patch of heel remained on the side wall of the TC at approximately the 5 o'clock position. In addition, there appeared to be a reasonably large pool of rinsate collected on the low end.

The remaining liquid was pumped from the parent resulting in the additional removal of 102 pounds of rinsate. A second video examination showed that a majority of the heel had been removed from the lower portion of the ton in the vicinity of the spray zone, while the heel in the upper area remained essentially intact. It was decided that an additional spray would be much more effective in the upper end of the TC. A second spray was implemented in the upper (15”) hole during which an additional 10.23 gallons of water was sprayed in.

The ton was repositioned so that the drain tube could be inserted in the lower (10”) drain hole. The drain pump was started and operated until all of the rinsate was removed. A total of 179 pounds of rinsate was transferred, resulting in an 87 pound parent weight decrease which yielded a total heel reduction of 323 pounds as a result of adding 199 pounds of water.

HRS Test #4 Summary Report

October 11, 2007
Ton D# - 78735
Initial Heel Weight (after agent drain) – 755 pounds
Planned Spray – 10 gallons
Planned Sequence – Spray with 30 minute soak time

This test consisted of spraying 10 gallons of 120°F water followed by a 30 minute soak time.

First entry
Although the "priming" operation was intended to be routine, the rinsate pump was not "primed" before this test because this is the first test in which spray is followed by a controlled soak test. Because of the additional rinsate removed in Test #3 after the heel was allowed to sit between the first and second entries, it was speculated that the soak time might be sufficient to fluidize the heel such that it could be transferred. To test this theory, the priming was skipped.

The video of the inside of the parent ton showed that the heel was spread fairly evenly along the ton. However, it was sloped up one side and was distributed as if the bottom of the ton was at approximately the 135 degree point with zero degrees being the top. This is virtually identical to the previous ton test.

Ten gallons of approximately125°F water was sprayed in followed by 30 minutes of soak time. The rinsate temperature, taken shortly after the 30 minute soak time began, was 94 degrees. At the end of the soak time, the rinsate transfer pump was started, but only a few gallons of rinsate was transferred before the pump stopped. The pump was primed and tried again. Additional rinsate was transferred. The total rinsate transferred was 179 pounds, of which 98 pounds (i.e., 10 gallons spray plus one, 15 pound prime) was water. The difference in the rinsate weight minus the water added yields a parent heel reduction weights of 83 pounds. This is in contrast to the 120 pound parent heel weight reduction obtained directly from the load cells. This discrepancy is likely due to the estimate of the priming water volume and the inconsistencies in the load cells although further effort will be required to further deduce the source of the error.

Second Entry
The second entry began with a video examination of the first spray with 30 minute soak time results. The video indicated that considerable heel had been removed in the lower end of the ton, but a substantial amount was still present along the 135 degree angle where the majority of the heel originally resided. In other words some of it had been removed, but quite a bit was still left. Similar to the previous test, there appeared to be a reasonably large pool of liquid rinsate remaining in the low end. This remaining liquid was pumped from the parent resulting prior to performing the next spray and drain.

Because the video examination showed considerable heel still present on the low end of the ton, an additional spray was conducted in the original 27" hole. The second spray volume was 6 gallons at a temperature of 122°F. This was followed by a 5 minute soak at which time the drain pump was started without difficulty. This drain resulted in the removal of an additional 112 pounds of rinsate. Since the heel weight was 493 pounds, or 3 pounds over the L4 limit at this point, an additional drain operation was conducted which resulted in the removal of an additional 11 pounds of rinsate. The net effect of the operations performed during the second entry was to transfer a total of 307 additional pounds of rinsate of which 50 pounds (6 gallons) was spray water. This of course includes the rinsate that was drained prior to the performance of the second spray.

The final result of the combined first and second sprays was that the initial 755 pound heel was reduced by 273 pounds to a final weight of 482 pounds as measured by the load cells with a total of 147 pounds of water using data from the flow meter. This resulted in the generation of 486 pounds of rinsate as shown by the Child TC load cell calculations. Using the 486 pounds of rinsate shown from the data sheet and subtracting the water weight of 147 pounds, the heel reduction weight is 339 pounds, 66 pounds greater than the weight calculated from the Parent TC load cell.

Final video examination of the TC indicated that virtually all of the heel had been removed in the lower half of the TC where the water spray was directed.

<u>Analysis</u>
The 30 minute soak time did not appear to offer any advantage over the simultaneous spray and drain test conducted in Test #3. The theory that the soak time might allow additional heel to fluidize appears to be incorrect since the rinsate removed per the first spray and drain was essentially the same as Test #3 and the pump operated virtually the same regarding it's inability to pump very well after the first spray and drain cycle. A more plausible scenario is that the initial amount of water sprayed in (i.e., 10 gallons) is an insufficient quantity to fully fluidize the amount of heel broken into small pieces by the high pressure spray. The resulting matrix is likely too thick and too viscous to be removed by the rinsate transfer pump. The next test will utilize a larger amount of water relative to the initial heel size in order to test this theory.

The discrepancy in the two methods of calculating heel weight is unknown at the current time but is believed to be due to load cell inaccuracy and repeatability.

HRS Test #5 Summary Report

October 12, 2007
Ton D# - 17759
Initial Heel Weight (after agent drain) – 660 pounds
Planned Spray – 15 gallons
Planned Sequence – Spray with 30 minute soak time

This test consisted of spraying 15 gallons of 122°F water followed by a 30 minute soak time.

First entry

Because of the continued speculation that the pump difficulty was solely due to the rinsate matrix being too thick to pump, the priming operation was not performed at the beginning of the test.

The video of the inside of the parent ton showed that the heel was spread evenly along the bottom of the ton except for a concentration of heel in one corner of the ton near the upper, eductor tube end. This protruding mound appeared to have the white grainy consistency found on previous tons in which there was a lot of material on the side of the ton. The balance of the heel on the bottom of the ton had numerous, small lighter protrusions coming from a relatively flat surface covered with a thin layer of dark colored liquid.

Fifteen gallons of approximately122°F water was sprayed in followed by 30 minutes of soak time. The rinsate temperature, taken shortly after the 30 minute soak time began, was 102 degrees. At the end of the soak time, the rinsate drain tube was lowered all the way down and the rinsate transfer pump was started by slowly turning on the air. The pump began pumping immediately and continued without incident until all of the rinsate was removed. The drain tube was raised and lowered back to the bottom, then the rinsate transfer pump was again started to see if any additional liquid could be removed. Only three additional pounds were removed at which point he pump was stopped. A total of 253 pounds of heel were removed from the parent during this drain which reduced the parent weight to 377 pounds.

During this test the installed VOC monitor showed a reading of zero.

Second Entry

The second entry began with a video examination of the first spray with 30 minute soak time results. The video showed that a majority of the heel was gone from the lower, spray end of the ton. A small amount of liquid was on the bottom but it appeared to be a thin layer that the pump was unable to pick up. The test director determined that there was no point in trying to drain any more rinsate out since there was such a minimal amount present.

Analysis

This test was very successful in that the pump performed satisfactorily without having to prime it. The first spray and 30 minute soak time removed all heel in the vicinity of the spray zone and resulted in a total removal of 253 pounds of heel with only 125 pounds (15 gallons) of water. What is not known is whether or not a smaller amount of water would have resulted in similar heel removal results given the initial heel configuration. An attempt will be made to answer this test question in subsequent tests. Similarly, since this test overshot the L4 target by 113 pounds, an attempt will be made to use less water in order to control the amount of heel removed instead of removing all heel possible in the vicinity of the spray zone. One potential problem with this objective is that early indications are that a minimum amount of water may be necessary in order to fluidize the heel that is broken up by the vigorous spray action. If all heel in the vicinity of the spray zone is broken up into smaller pieces, it may behave as a sponge and retain the small amount of water sprayed in, thus preventing the creation of a pumpable slurry. This too will be tested in subsequent tests. In the end, should this scenario be determined to be correct, a likely solution would be to not use the current test criteria which is that all rinsate be drained from the ton. Instead, only the desired amount of rinsate would be removed.

HRS Test #6 Daily Overview

October 13, 2007
Ton D# - 14171
Initial Heel Weight (after agent drain) – 572 pounds
Planned Spray – 7 gallons
Planned Sequence – Spray with 30 minute soak time

This test consisted of spraying 7 gallons of 122°F water followed by a 30 minute soak time.

First entry

The video of the inside of the parent ton showed that the heel was spread evenly along the ton except it was sloped up the side. The centerline of the heel was at approximately the 135 degree mark as previously observed. Due to the location of the heel, there was considerable liquid agent in the trough opposite the heel. This liquid will likely be drainable after the spray process removes heel such that the drain tube can be lowered to the bottom.

Seven gallons of approximately122°F water was sprayed in followed by 30 minutes of soak time. The rinsate temperature, taken halfway through the 30 minute soak time began, was 92 degrees. At the end of the soak time, the rinsate drain tube was lowered all the way down and the rinsate transfer pump was started by slowly turning on the air. The pump began pumping immediately and continued without incident until all of the rinsate was removed. The drain tube was raised and lowered three times during the drain process in an effort to move the drain tube in and out of any "muck" that was on the bottom. This was performed because the drain tube obviously had not hit a hard bottom since it would slowly sink down further at the end of its initial travel stop. A total of 161 pounds of heel were removed from the parent during this drain which reduced the parent weight to 411 pounds. The child rinsate weight was 235 pounds.

During this test the installed VOC monitor showed a reading of zero. No strainer was installed.

The final video examination, as reported by the CON operator, showed all liquid removed but still quite a bit of heel in the vicinity of the spray zone. This will be examined by the test director later.

The test was completed with one entry.

Analysis

This test was very successful in that the ratio of heel to water continued to increase. The mass of the 7 gallons of water sprayed in is equal to 58 pounds as opposed to the data sheet calculation of 74 pounds of water. Added to the heel removed weight of 161 pounds the total is 219 pounds. While not an exact match with the rinsate mass of 235 pounds, it is probably within the tolerance of the load cells. Since we have a high confidence level in the water weight calculated from the volume, it is likely that the 161 pounds of heel is a minimum, and may very well be more. Even using the 161 pound number, the heel to water ratio is 2.78.

With only a 7 gallon spray volume, and its associated 2.5 minute spraying time, it is not surprising that there was still some heel left as reported by the CON operator from his look at the video.

The considerable amount of liquid agent that remained in the ton after the initial agent drain step no doubt had a significant contribution to the amount of "heel" removed. An analysis of this heel configuration will be required as we go forward in an attempt to draw a correlation as to the total contribution this configuration adds to the heel/water removal ratio.

Although it may be moot at this point, if video examination of a TC showed heel at the 135 degree configuration, additional draining using the agent drain tube should be possible by simply using a "shovel" to manually move the heel aside immediately below the punch hole, thus allowing the drain tube to go all the way to the bottom and suck out the liquid remaining.

HRS Test #7 Daily Overview

October 14, 2007
Ton D# - 36831
Initial Heel Weight (after agent drain) – 717 pounds
Planned Spray – 12 gallons
Planned Sequence – Spray with 30 minute soak time

This test consisted of spraying 7 gallons of 122°F water followed by a 30 minute soak time.

Prior to the entry, the TI-500 was found to have been broken off, probably during the entry to install the new splash guards. From operational experience, TI-300, TI-400, and TI-500 all indicate temperatures within 2-3 degrees of each other therefore TI-400 will be used for the spray temperature.

After performing the initial video, it was found that a significant amount of liquid agent remained in the TC. Re-draining the TC removed an additional 113 pounds of agent, down to a 604 pound solid heel. Because of this, 7 gallons of water were used instead of the originally intended 12/13 gallons.

After the 30 minute soak time, approximately 100 pounds of rinsate were able to be pumped out. It was assumed at the time that the pump was losing its prime because so little rinsate was removed for the 70 pounds of water that was introduced. Two priming operations were performed, as well as two full open/full close drain tube clearing operations. When no further agent could be removed, the after video was taken which showed only a sheen of rinsate was left on top of the agent heel.

No further rinse and drain operations were pursued at this point (final heel was 563 lbs) due to the fact that two other tasks were piggybacked onto this entry (sump leak detector and decon hose replacement) and with the unfamiliarity of the entrants with the tasks, there was a high risk of having the child and parent blocking both lines at the end of the entry. A third entry wouldn't be able to get in until 1900 at the earliest due to shift turnover.

HRS Test #8 Daily Overview

October 15, 2007
Ton D# - 85695
Initial Heel Weight (after agent drain) – 664 pounds
Planned Spray – 12 gallons
Planned Sequence – Spray with 30 minute soak time

This test consisted of spraying 12 gallons of 122°F water followed by a 30 minute soak time.

First entry
The video of the inside of the parent ton showed that the heel was spread evenly along the ton except it was sloped up the side. The centerline of the heel was at approximately the 150 degree mark.

Twelve gallons of approximately122°F water was sprayed in followed by 30 minutes of soak time. The rinsate temperature, taken halfway through the 30 minute soak time began, was 98 degrees. At the end of the soak time, the rinsate drain tube was lowered all the way down and the rinsate transfer pump was started by slowly turning on the air. The pump began pumping immediately and continued without incident until all of the rinsate was removed. The drain tube was raised and lowered two times during the drain process in an effort to move the drain tube in and out of any "muck" that was on the bottom. The initial drain resulted in a parent weight of 500 pounds. After videoing, the ton was moved back to drain position and an additional 18 pounds of heel was removed. A total of 182 pounds of heel were removed from the parent during this drain which reduced the parent weight to 482 pounds. The child rinsate weight was 326 pounds.

No VOC meter was installed. No strainer was installed.

The final video examination showed all liquid removed but a moderate amount of heel remained in the vicinity of the spray zone.

The test was completed with one entry.

Analysis
Once again the test was successful but a discrepancy once again exists between the water calculated via the load cells and the water calculated per the flow meter. The flow meter is believed to be far more accurate and will be used for summary calculations. As confirmation, the calibration of the flow meter will be checked tomorrow.

HRS Test #9 Daily Overview

October 16, 2007
Ton D# - 82730
Initial Heel Weight (after agent drain) – 755 pounds
Planned Spray – 14 gallons
Planned Sequence – Spray with 30 minute soak time

This test consisted of spraying 14 gallons of 125°F water followed by a 30 minute soak time. This was followed by a 4 gallons spray with no soak time.

First entry
The video of the inside of the parent ton showed that the heel was spread evenly along the ton except it was sloped up the side. The centerline of the heel was at approximately the 150 degree mark.

No VOC meter was installed. No strainer was installed.

Fourteen gallons of approximately125°F water was sprayed in, followed by 30 minutes of soak time. The rinsate temperature was taken at the beginning and the end of the soak time and was 98 degrees in both cases. At the end of the soak time, the rinsate drain tube was lowered all the way down and the rinsate transfer pump was started by slowly turning on the air. The pump began pumping immediately and continued without incident until all of the rinsate was removed. The drain tube was raised and lowered two times during the drain process in an effort to move the drain tube in and out of any "muck" that was on the bottom. The initial drain resulted in a Parent TC reduced by 204 pounds to a weight of 551 pounds and a Child weight of 331 pounds. Since the 490 pound objective had not been reached, a second 4 gallon spray was conducted followed by an immediate drain. During this second spray, the spray wand was started at the 20" insertion point and then lowered to the full insertion point where it stayed for the remainder of the spray. This stationary location for 30 – 45 seconds could have been detrimental to the amount of heel removed. The parent weight was reduced another 52 pounds to 499 pounds as a result of the second spray. The entry time expired at this point so further testing was suspended until the next entry.

Second entry
An additional drain, without spray, was performed at the beginning of the entry resulting in the removal of an additional 17 pounds of rinsate which lowered the final weight of the ton to 482 pounds, an L4 category. The total amount of heel removed, from both sprays, was 273 pounds and this was accomplished with 18.3 gallons (151 pounds) of water. This results in a heel/water ratio of 1.81. The final child rinsate weight was 434 pounds.

The final video examination showed virtually all liquid removed and a small amount of heel remaining in the outer edges of the spray zone.

Analysis

This test was successful but it did require two spray and drain cycles (followed by a small 3rd drain on the second entry) to achieve the L4 category. There is insufficient data at this time to say that two spray and drain cycles will be required to achieve the L4 category when starting with a 755 pound heel. Test #4 also had a 755 pound heel and the weight was successfully reduced to, coincidentally, 482 pounds with only 16 gallons of water. In that test however, there were pump problems due to only using 10 gallons on the first spray. The current test had attempted to achieve the L4 objective on the first spray with only 14 gallons of water. In coming tests, an attempt will be made to see if it is more appropriate to use two smaller volume sprays or one large volume spray. However, as has always been learned in previous tests, using too small a volume on the first spray (i.e., 10 gallons on Test 4) results in a rinsate too thick too pump. If an additional ton is encountered in this weight range, a single spray of 16 gallons will likely be tried. Long term, it will not make any difference if one, two or even three sprays is required. The prime objective is to maximize the overall heel to water ratio.

HRS Test #10 Daily Overview

October 17, 2007
Ton D# - 17288
Initial Heel Weight (after agent drain) – 733 pounds
Planned Spray – 16 gallons
Planned Sequence – Spray with 30 minute soak time

This test consisted of spraying 16 gallons of 125°F water followed by a 30 minute soak time.

First entry
The video of the inside of the parent ton showed that the heel was spread evenly along the ton except it was sloped up the side. The centerline of the heel was at approximately the 150 degree mark.

No VOC meter was installed. No strainer was installed.

Sixteen gallons of approximately125°F water was sprayed in, followed by 30 minutes of soak time. No rinsate temperature was taken. At the end of the soak time, the rinsate drain tube was lowered all the way down and the rinsate transfer pump was started by turning on valve 123 fully without the gradual opening previously performed. The pump began pumping immediately. Total heel removed was 273 pounds with a total water volume of 16.23 gallons (134 pounds) which yields a 2.0:1 heel to water ratio. The final Parent heel weight was 460 pounds with a final Child weight of 421 pounds.

The spray wand stroke was modified by keeping the wand at a higher height for more of the spray cycle. This was done in an effort to have the 45 degree spray nozzle provide more spray time for the heel located farther away from the spray wand. The stroke consisted of starting at 20", travel down to 25", up to the 10" position, down to 18", back up to 10", and then back down to the full insertion limit of 26.5". At about the 18" level, the spray hose counterweight got hung up and would not allow the spray wand to go in any further. After several strokes up and down around the 16" to 18" level in an effort to free the wand, the wand control joystick was held in the extend position. This additional pressure broke the tie-wrap that had gotten hung up at which time the wand jumped to the full insertion hard stop. This action took about a minute which limited the range of the spray pattern for that amount of time. The counterweight was removed after the test since it had not been working anyway and we didn't want it to hang up again.

The final video examination showed most of the liquid removed in the spray zone.

All work was completed on the first entry.

Analysis

This test was highly successful by removing all of the heel with one spray and achieving a 2:1 ratio. It is unknown how the stuck spray wand affected the results but the modified stroke cycle will definitely be repeated because of the good results.

HRS Test #11 Daily Overview

October 18, 2007
Ton D# - 32252
Initial Heel Weight (after agent drain) – 795 pounds
Planned Spray – 16 gallons
Planned Sequence – Spray with 30 minute soak time

This test consisted of spraying 16 gallons of 125°F water followed by a 30 minute soak time. This was followed by a 4 gallon spray with an immediate drain. This was followed on the second entry by a 3rd, 2 gallon spray with an immediate drain. The 2nd and 3rd sprays were required to reach an L4 level in the Parent TC.

First entry
The video of the inside of the parent ton showed that the heel was spread evenly along the ton except it was sloped up the side. The centerline of the heel was at approximately the 150 degree mark.

No VOC meter was installed. No strainer was installed. No rinsate temperature was taken.

Sixteen gallons of approximately125°F water was sprayed in, followed by 30 minutes of soak time. The spray wand cycle went very smoothly including an additional two cycles at the top 10" to 18" range. The operator moved the wand about one inch every 5 seconds. At the end of the soak time, the rinsate drain tube was lowered all the way down and the rinsate transfer pump was started by turning on valve 123 fully without the gradual opening. The pump began pumping immediately but seemed to stall after 80 pounds was transferred. Moving the drain tube up and down was successful in getting the pump to start pumping again. The drain tube was raised and lowered four times during the drain process in an effort to move the drain tube in and out of any "muck" that was on the bottom. The drain resulted in a Parent TC reduced by 231 pounds to a weight of 564 pounds and a Child weight of 376 pounds.

It was desired to achieve an L4 level so a second 4 gallon spray was performed followed by an immediate drain. This spray was started with the spray wand in the 10" position and then lowered in one inch increments to the full insertion limit. The drain process resulted in the removal of an additional 48 pounds of heel removed bringing the parent weight down to 516 pounds. The entry time expired at this point the test.

Second entry
A third drain was performed as the first activity of this entry in the hopes that 26 pounds of heel could be removed from the parent without an additional spray. Unfortunately only 15 pounds was removed which made the parent weight 501 pounds.

Video of the Parent showed that much of the heel had been removed in the vicinity of the spray but there was enough left, specifically in the corner, that the decision was made to perform a third spray in the same 27" hole rather than move to the 15" hole and take a chance of generating too thick a rinsate given the small amount of water which was to be sprayed in.

A third 2 gallon spray was performed followed by an immediate drain. This resulted in the removal of an additional 12 pounds of rinsate which lowered the final weight of the ton to 489 pounds, an L4 category.

The total amount of heel removed, from all three sprays, was 306 pounds and this was accomplished with a three spray total of 22.66 gallons (187 pounds) of water. This results in a heel/water ratio of 1.64. The final child rinsate weight was 507 pounds, an L6 category ton.

A final video was not taken since there was likely to be minimal difference from the previous video.

Analysis

This test seems to indicate that being too aggressive in terms of minimizing the amount of water used can actually result in using more water because of the diminishing returns achieved with subsequent spray and drain cycles through the same 27" punch hole. It is speculated that a single 19 or 20 gallon spray would have been successful. If this were true, a heel water ratio near 2:1 would have been achieved. This will be tested in subsequent tests if a similar heel weight is encountered, although it is planned to raise the spray temperature by 25 degrees which will result in an additional variable to consider.

HRS Test #12 Daily Overview

October 19, 2007
Ton D# - 82461
Initial Heel Weight (after agent drain) – 730 pounds
Planned Spray – 16 gallons
Planned Spray temperature – 145°F
Planned Sequence – Spray with 30 minute soak time

This test was performed on one of two “flat tray” (TC lying flat with no tilt to the “lower” 10” drain hole) tons that had been previously drained per normal operations but did not achieve the 630 pound limit required. This test consisted of spraying 8 gallons of 137°F water followed by a 25 minute soak time and attempted drain. This was followed on the second entry by an 8 gallon spray with an immediate drain.

<u>First entry</u>
The video of the inside of the parent ton showed that the heel was spread evenly along the length of the ton. The centerline of the heel was at the 180 degree mark. Heel was sloped up both sides of the ton a few inches. The entire flat portion of the heel was covered with a thin, maybe ½” layer of liquid agent.

No strainer was installed.

The spray operation was performed through the eastern most hole that had been punched per normal operations. This hole was estimated to be about 20” from the end. Six and a half gallons (out of a planned 16 gallons) of approximately137°F water was sprayed in when the low alarm (10% LEL) on the combustible gas monitor was received. The monitor reading was checked and it indicated 16% LEL at which time the hot water spray was terminated from the corridor. The reading quickly dropped out of alarm and the PSM and Test Director agreed to resume the spray. An additional two gallons of spray was introduced when the monitor again went into alarm and reached 18% LEL. Further spray was terminated. The rinsate temperature was taken and found to be 104°F. After a 25 minute soak time the pump the drain tube was lowered into the ton. The drain tube slowed down as it entered the heel and then lurched forward and reached the fully inserted position. The rinsate pump was started but no rinsate was transferred. The rinsate drain tube was cycled up and down a few inches several times. The pump was checked to ensure it was working and it was found to be working satisfactorily. At this point the entry time had expired so the test was stopped.

A PORC meeting was convened to discuss the path forward due to the likelihood that VOCs still remained in the ton. The decision was made to reduce the spray temperature to 120°F, raise the VOC alarm action limit to 40% LEL, and add a second FiveStar combustible gas monitor that the entrant would hold while reading the other instruments that had the distill end mounted at the TC punch hole.

<u>Second Entry</u>

One combustible gas monitor was placed one inch above the punch hole opening. The PID was placed below the magnetic cover of the punch hole. The second combustible gas monitor was held by the entrant.

An additional eight gallons of 123F water was sprayed into the ton without incident. The reading on the combustible gas monitor mounted at the TC punch hole steadily increased up to a maximum of 20.4% and then stabilized around that point. The handheld meter read zero the entire time. The PID read 200ppm as soon as it was installed and rose to 213ppm at the end of the test. This meter is suspected to be erroneous data.

The rinsate was held for a 15 minute soak time. The rinsate drain tube was lowered to the bottom. The rinsate pump was started and it successfully pumped the entire rinsate mass without difficulty. The drain tube was raised and lowered one or two inches three times during this evolution. A total of 219 pounds of heel was removed from the parent resulting in a final Parent weight of 511 pounds and a Child weight of 395 pounds. A total of 16.69 gallons (137 pounds) of water was sprayed in.

The post drain video was not taken due to camera failure and the inability to locate the backup camera that had been placed in the MPB.

<u>Analysis</u>
The higher temperature water appears to cause the production of VOCs. Further tests will be conducted at lower temperatures.

HRS Test #13 Daily Overview

October 20, 2007
Ton D# - 81158
Initial Heel Weight (after agent drain) – 651 pounds
Planned Spray – 12 gallons
Planned Spray temperature – 120°F
Planned Sequence – Spray with 30 minute soak time
This test consisted of spraying 12 gallons of 127°F water followed by a 30 minute soak time.

First entry
The video of the inside of the parent ton showed that the heel was spread evenly along the length of the ton. The centerline of the heel was at the 180 degree mark. The high end of the ton had heel sloped up several inches. The low end of the ton had heel sloped up in one corner with the other corner completely free of heel.
No strainer was installed. One combustible gas monitor (CGM) was installed two inches above the upper punch hole.

A 12.21 gallon water spray at a temperature of about 127F was sprayed in. The spray wand cycle started at 20”, down to 25”, up to 10”, down to 18”, up to 10”, down to full insertion. The spray ended at the full insertion point. Four gallons into the spray the CGM went into alarm on CO. Shortly later a CG reading of 2% was obtained. This climbed to a maximum of 5% where it remained for the last minute of the spray. Upon stopping the spray the reading dropped immediately.

A thirty minute soak time was performed at which time the drain tube was fully extended. When it reached the heel it slowly dropped approximately one inch as it was presumably sinking into “muck”. The rinsate pump was started and ran fine for about 80 pounds at which time it stopped pumping. The drain tube was pulled up for examination and was found to be plugged. A rubber hose (presumably from area 10) was found wrapped around the drain tube with heel material clumped around the hose. The entrant removed the debris and the drain tube was reinserted. The pump was started and another 230 pounds of rinsate was removed. The total amount of heel removed from the Parent TC was 199 pounds with a final Child TC rinsate weight of 312 pounds. Using the 12.21 gallon (101 pound) water mass sprayed in the resulting heel to water ratio was 1.98.

The post drain video was not taken due to lack of time in the entry. Performing another entry solely for the video was not warranted since the test had the predicted results except for the hose clogging the rinsate pump.

Analysis
The slight quantity of VOCs produced was likely due to the fact that the supplied water temperature 127F was higher than any previous nominal 120F tests. The next test will be performed at temperature of 100F to see if the same 2:1 ratio can be maintained. If similar results are obtained, that temperature will be lowered more.

HRS Test #14 Daily Overview

October 21, 2007
Ton D# - 43499
Initial Heel Weight (after agent drain) – 657 pounds
Planned Spray – 12 gallons
Planned Spray temperature – 100°F
Planned Sequence – Spray with 30 minute soak time

This test consisted of spraying 12.24 gallons of 101°F water followed by a 30 minute soak time.

We changed to 100°F water for this test to test the effectiveness of lower temperature water spray.

The TC for TCT 14 was very similar to TCT 13: 657 vs. 651 pound heel, 12.24 gal (125 pounds) vs. 12.21 (113 pounds) water added, 459 vs. 452 pound final heel. The pump, however, performed vastly different for this test. The rinsate just didn't seem to be as pumpable, and the drain tube became clogged much more easily. After the first attempt to pump, 164 pounds of rinsate was transferred. The ton was then moved into position to video, at which point there seemed to be plenty of liquid left to remove. It looked as if there was solid heel directly below the drain hole, so the spray hole was used to drain from next. Several further attempts to drain were made, all of which used jogging the tube up and down and retracting the tube to remove solid material from the holes.

Once final weights were taken, 323 pounds of rinsate were transferred, 198 pounds of which were heel.

So, 100F water gives ABOUT the same removal efficiency. However, the resultant liquid is much more difficult to work with. It looks like 120F-130F water is the "sweet spot".

HRS Test #15 Daily Overview

October 22, 2007
Ton D# - 7107
Initial Heel Weight (after agent drain) – 571 pounds
Planned Spray – 6 gallons
Planned Spray temperature – 120°F
Planned Sequence – Spray with 20 minute soak time

This test consisted of spraying 6 gallons of 120°F water followed by a 20 minute soak time to help determine the minimum amount of water that would liquefy the heel. This was followed by two additional two gallon sprays with immediate drains.

First entry
The video of the inside of the parent ton showed that the heel was spread evenly along the length of the ton. The centerline of the heel was slightly slewed to about the 170 degree mark.

No strainer was installed. One combustible gas monitor (CGM) was installed two inches above the upper punch hole.

A 6.22 gallon water spray at a temperature of 122°F was sprayed in. The spray wand cycle started at 21", down to 26.5", up to 10", down to 18", up to 10", down to full insertion. The spray ended at the full insertion point. No readings were received on the CGM.

A twenty minute soak time was performed at which time the drain tube was fully extended. When it reached the heel it slowed down but it did reach the fully inserted, 35.5" position. The rinsate pump was started but no rinsate was pumped. As always when the pump fails to work, the drain tube was raised and lowered a few inches in an attempt to clear the tube should it be clogged. The drain tube was raised and it had a round ball of sticky heel attached to it but it didn't appear to be clogged per se, rather the heel mass was still too thick and sticky to pump.

An additional 2 gallons was sprayed in after the usual purge. The drain tube was immediately lowered, the rinsate pump started, and was able to pump about a hundred pounds of rinsate. What portion of this was heel is unknown because an intermediate parent weight was not taken. When the pump stopped pumping, the drain tube was raised and found to still have a large ball of sticky heel attached.

A third spray cycle, consisting of 2 gallons, was performed. During this cycle the drain tube was lowered down so that the spray cycle would wash the bottom of the drain tube. At the end of the spray and before the drain, the drain tube was raised and found to be completely clear of heel. The rinsate pump was started and ran fine until all available rinsate was transferred. The third spray successfully made the heel pumpable and resulted in a total heel removal of 247 pounds and yielded a final Parent weight of 324 pounds. This was accomplished with a total of 10.58 gallons (87 pounds) resulting in a 2.8 heel to water ratio. The final Child rinsate weight was 364 pounds.

<u>Second Entry</u>
The post drain video showed that all except a tiny amount of heel had been removed in the spray zone. Some liquid remained which could have resulted from the roughly three hour time lapse between entries. No attempt was made to pump this volume but it is estimated that two or three gallons could have been pumped out.

<u>Analysis</u>
The 6 gallon initial volume was selected to try and better the 7 gallons that successfully worked on a similar heel mass in Test 6. The only identifiable difference between Test 6 and this test is that Test 6 had the heel located well up the side of the ton rather than nearly flat on the bottom like this test. It is speculated that due to better spray wand control currently being utilized, and since more time is now spent at the top of the spray cycle, the spray zone was effectively made larger this time which meant that the water was spread out, and in contact with more heel thus reducing its effectiveness at mobilizing the heel. The result was more water was required to liquefy the heel and more heel was liquefied in the process. If this size heel comes up again, the spray stroke will be purposely limited to the bottom half of the cycle to minimize the size of the spray zone. This should make it possible to liquefy a smaller mass of heel which is the desired objective when dealing with a 550 – 600 pound heel.

HRS Test #16 Daily Overview

October 23, 2007
Ton D# - 92896
Initial Heel Weight (after agent drain) – 691 pounds
Planned Spray – 14 gallons
Planned Spray temperature – 120°F
Planned Sequence – Spray with 15 minute soak time

This test was conducted on a flat tray (TC not tilted) heavy ton. This test consisted of spraying 14 gallons of 120°F water followed by a 15 minute soak time. This was followed by a single 7 gallon spray with an immediate drain.

First entry
The video of the inside of the parent ton showed that the heel was spread evenly along the length of the ton. The centerline of the heel was at about the 135 degree mark (i.e., 45 degree slope.

No strainer was installed. Batteries on both combustible gas monitors went dead at the beginning of the test so no CGM was used.

Because this test was performed on a previously punched and drained TC outside of the scope of the SOP-118, the punch holes were not in the normal locations. The east end hole was approximately 20" in from the end and the middle hole was just about in the center of the ton. A 14.12 gallon (116 pound) water spray at a temperature of 125°F was sprayed in. The spray wand cycle started at 21", down to 26.5", up to 13", down to 20", up to 13", down to full insertion and halfway back up when spray ended.

A fifteen minute soak time was performed at which time the drain tube was fully extended. When it reached the heel it slowed down but it did reach the fully inserted, 35.5" position. The rinsate pump was started and a successful drain was conducted which removed 205 pounds of heel thus reducing the parent weight to 486 pounds. As usual, the drain tube was raised and lowered a couple of times but it did not provide any significant benefit. Although this first spray and drain was successful in reaching the L4 category, a heavier child was desired so an additional spray was performed through the middle hole of the parent. The heel to water ratio of this first spray and drain was 1.8.

The second spray consisted of a 7.08 gallon (58 pound) spray through the center hole of the TC. This spray resulted in the removal of an additional 118 pounds of heel which reduced the parent to 368 pounds. The heel to water ratio of this second spray was 2.0.

The post video showed that a vast majority of the heel had been removed in the two spray zones. A small amount of liquid remained in the bottom. The liquid level was impossible to discern, but it is likely that this was residual that could not be pumped out with the configuration of the drain tube and the flat tray being used.

Second Entry

An additional drain was performed which resulted in the removal of an additional 9 pounds of rinsate. The net result of two sprays and three drains was that 332 pounds of heel was removed yielding a final parent weight of 359 pounds and a child weight of 524 pounds. With a total sprayed water volume of 21.2 gallons (180.2 pounds) a final heel to water ratio of 1.9 was achieved.

Analysis

The required water volume prediction was accurate in that a successful first drain was accomplished with no pumping issues and a heel to water ratio of 1.8 that was within the range of expected values. There will never be a way of really knowing if less water could have been used for this or any other specific test. No other significant new information was learned during this test.

HRS Test #17 Daily Overview

October 24, 2007
Ton D# - 81352
Initial Heel Weight (after agent drain) – 596 pounds
Planned Spray – 7 gallons
Planned Spray temperature – 120°F
Planned Sequence – Spray with 5 minute soak time

The primary purpose of this test was to determine if a limited volume, limited spray stroke would aid in the removal of a smaller amount of heel rather than "overshoot" and remove too much heel as had been done previously for heels less than 600 pounds. The test consisted of spraying 7 gallons of 120°F water followed by a 5 minute soak time. This was followed by a two additional 7 gallon sprays and a single 4 gallon spray, all with drains occurring within 5 minutes of the spray.

First entry
The video of the inside of the parent ton showed that the heel was spread evenly along the length of the ton. The centerline of the heel was at about the 165 degree mark (i.e., 15 degree slope.

No strainer was installed. No CGM was used. Hole punch positions were 11" and 28" from the low end of the ton and 28" from the high end of the ton. This upper end punch was located in this position to maximize the effectiveness of the planned 3rd spray.

A 7.13 gallon (59 pound) water spray at a temperature of 120°F was sprayed in the 11" "drain" hole. The spray wand cycle started at 21", down to 26.5" (hard stop), up to 16", down to 26.5". The purpose of spraying in this lowest hole, and the limiting of the maximum retraction height to 16" was to concentrate the water spray on a smaller mass of heel. With a given volume of water contacting a smaller mass of heel, the water to heel ratio within the smaller, wetted heel mass should be higher thus making a smaller mass of rinsate pumpable.

A five minute soak time was performed at which time the drain tube was fully extended. When it reached the heel it slowed down and ended up about an inch short of full insertion. The rinsate pump was started and a successful drain was conducted which removed 134 pounds of heel thus reducing the parent weight to 462 pounds. As usual, the drain tube was raised and lowered a couple of times but it did not provide any significant benefit. Although this first spray and drain was successful in reaching the L4 category, a heavier child was desired so additional sprays were performed. The heel to water ratio of this first spray and drain was 2.3.

The second spray consisted of a 7.12 gallon (58 pound) spray through the center hole of the TC. The spray stroke started at 21", raised to 12", lowered to full insertion, and raised to 10". This spray resulted in the removal of an additional 95 pounds of heel which reduced the parent to 367 pounds. The heel to water ratio of this second spray was

1.6. At this point in time the child rinsate weight was still only 357 pounds so additional sprays were required.

The third spray consisted of a 7.07 gallon (58 pound) spray through the high end, 28" punch hole of the TC. The spray stroke was started at 21", lowered to full insertion, raised to 10", and lowered to 17" when the spray cycle ended. This spray resulted in the removal of 89 pounds of heel which reduced the parent to 278 pounds. The heel to water ratio of this 3rd spray was 1.5. The child rinsate weight was still only 500 pounds so a 4th spray was performed.

The fourth spray consisted of a 4.07 gallon (34 pound) spray through the high end 28" hole. The spray stroke started at 21", went to full insertion, and retracted to the 10" position. This spray only removed an additional 39 pounds of heel which brought the parent weight down to only 239 pounds. The heel to water ratio of the 4th spray was only 1.1.

The post video showed that much of the heel had been removed throughout the ton. There were mounds around in a few locations, including strips along the bottom edge of the lower end of the ton, some small piles in the middle and the corners of the upper end of the ton. No large concentrations were left however so it was not surprising that the 4th spray had a poor heel to water ratio. There was quite a bit of liquid remaining in the bottom of the ton.

The net result of the four spray and drains was that 357 pounds of heel was removed yielding a final parent weight of 359 pounds and a child rinsate weight of 567 pounds. With a total sprayed water volume of 25.39 gallons (209 pounds) a final heel to water ratio of 1.7 was achieved.

Analysis

The first spray and drain cycle was highly successful by achieving the L4 category without overshooting the 490 pound limit by a large margin as had previously been done with smaller initial heel masses. The parent heel weight of 462 pounds was a reasonable result, particularly in the context of our original strategy plan "target" weight of 450 pounds. This should be an effective tool to utilize in operations.

The video showed that the Area 10 debris can cause additional problems besides plugging the drain tube. If the debris ends up under the drain tube, this prevents the drain tube from contacting the bottom which in turn prevents the pump from pumping out all of the rinsate it would normally be able to remove.

The lower heel to water ratio was expected due to the diminishing returns achieved from the 2nd, 3rd and 4th sprays on an already low heel mass. These follow on spray and drains were conducted solely to generate rinsate for child MPF testing. These drains would not normally be conducted and are outside the design basis for the HTS design. As such, the data for the 2nd, 3rd, and 4th spray and drains will not be used in the calculation of an aggregate ratio at the completion of all 20 TC tests.

The post video showed mounds of heel in the lower area of the ton that normally would have been thoroughly washed out. Almost certainly these mounds were chunks of heel that got washed down from the high end of the ton during the third spray. Once they became out of range of the 28” high end spray hole, they were no longer removable by this design with any reasonable water efficiency. As stated before, this was out of the design basis for the HTS design.

HRS Test #18 Daily Overview

October 25, 2007
Ton D# - 17830
Initial Heel Weight (after agent drain) – 545 pounds
Planned Spray – 20 gallons
Planned Spray temperature – 120°F
Planned Sequence – Spray with 15 minute soak time

The weight of this heel is 545 pounds which is less than the 550 pound minimum weight established for this testing. Nonetheless, logistics and coordination with the DCD dictates that the current three L6G tons in TOCDF possession must be used for the final three HTS tests. Accordingly, this 545 pound ton was used for Test #18. The primary objective was to generate a 600 pound child TC. It was speculated that this might best be accomplished by spraying water in the high end, 28" hole, and then in the low end, 28" hole, before performing the first drain.

The test consisted of spraying 10 gallons of 120°F water in the high 28" hole, followed by a spray in the low 28" hole followed by a 15 minute soak time and drain. This was followed by a 5 gallon spray in the 11" drain hole and a drain immediately after.

First entry
The video of the inside of the parent ton showed that the heel was spread evenly along the length of the ton. The centerline of the heel was at about the 180 degree mark (i.e., flat on the bottom). The heel was sloped up each side evenly about 4".

No strainer was installed. CGM was not used because the unit would not turn on. Hole punch positions were 11" and 28" from the low end of the ton and 28" from the high end of the ton.

A 10.04 gallon (83 pound) water spray, at a temperature of 124°F, was sprayed in the upper 28" hole. The spray wand cycle started at 21", down to 26.5" (hard stop), up to 10", down to 18", up to 10", and down to hard stop. No drain was conducted at this point. A 10.07 gallon (83 pound) spray, at a temperature of 124°F, was sprayed in the lower 28" hole. A fifteen minute soak time was conducted at which time the drain tube was lowered into the ton at the 11" punch hole until it contacted heel. The drain tube stopped nearly 4 inches from the bottom. Speculating that something other than heel was stopping the insertion, the drain tube was withdrawn and the ton was moved to align the drain tube with the lower 28" hole. The tube was again inserted but the tube again stopped 4 inches short of the bottom. The drain tube was relocated back to the 11" hole and inserted until it stopped. The rinsate pump was started and a successful drain was conducted which removed 230 pounds of heel thus reducing the parent weight to 315 pounds. As usual, the drain tube was raised and lowered a couple of times but it did not provide any significant benefit. The heel to water ratio of this first spray and drain was 1.4.

A video was performed at this point to determine why the drain tube did not go all the way down. The video showed considerable heel at numerous locations throughout the ton including much more than expected on the lower end of the ton.

The third spray consisted of a 5.12 gallon (44 pound) spray through the 11” drain hole of the TC. The spray stroke started at 21”, lowered to full insertion, raised to 10”, and lowered half way down to full insertion when the spray ended. The spray wand was removed and the drain tube was placed in the same 11” hole. The drain tube stopped two inches short of the bottom despite the localized, concentrated action of the spray wand. This spray resulted in the removal of an additional 50 pounds of heel which reduced the parent to 265 pounds. The heel to water ratio of this second spray was 1.1. Although the child rinsate weight was only 522 pounds, additional spray and drains were not performed due to the high volume of water being required to remove this particular heel. It was not desired to dilute the child rinsate any further.

The post video showed that there was still heel on the entire bottom of the ton including in the vicinity of the 11” punch hole.

The net result of the three sprays and two drains was that 280 pounds of heel was removed yielding a final parent weight of 265 pounds and a final child weight of 522 pounds. With a total sprayed water volume of 25.23 gallons (208 pounds) a final heel to water ratio of 1.35 was achieved.

<u>Analysis</u>

This test showed reduced effectiveness compared to previous tests. Although the test plan was modified by spraying 10 gallons each into both the upper and lower 28” holes before a drain was performed, it is not believed that this had any impact on the results. Certain scenarios could have been speculated that the modified sequence would impact the results in a negative way, however, these became moot when the third spray and drain in the lower 11 inch hole failed to remove the remaining heel in the lower vicinity so that the drain tube could be lowered to the bottom. Previous results indicated a strong likelihood that this step should have been successful. Since it only removed a small amount of heel, the likely scenario is that the heel is harder to emulsify than in previous tests. The video appears to show a more solid, dark mass on the bottom of the ton. Speculation is that this could be an early iron precipitate that solidified on the bottom. Subsequent mustard degradation products then came along and precipitated out on top of this very solid bottom mass.

Despite the harder heel, this data was discovered only when performing testing well outside the design basis for the system, and on a TC that would not normally be sent through the HTS process. For a normal high heel TC, it is probable that more “regular”, easily removable heel would sit on top of this harder heel thus yielding results similar to those previously seen.

HRS Test #19 Daily Overview

October 26, 2007
Ton D# - 52455
Initial Heel Weight (after agent drain) – 585 pounds
Planned Spray – 10 gallons x 2
Planned Spray temperature – 120°F
Planned Sequence – Spray with 15 minute soak time

One objective of this test was to generate a heavy child TC, preferably in the 600 pound range. Accordingly two sprays were planned; one in the lower 28" hole, and a second in the upper 28" hole.

The test consisted of spraying 10 gallons of 120°F water in the low 28" hole followed by a 15 minute soak time and a drain. A second 4 gallon spray was performed in the low 28" hole followed by an immediate spray and drain. A third 10 gallon spray was conducted in the upper 28" hole followed by an immediate drain.

First entry
The video of the inside of the parent ton showed that the heel was spread evenly along the length of the ton. The centerline of the heel was at about the 180 degree mark (i.e., flat on the bottom). The heel was sloped up each side evenly about 4".

No strainer was installed. No CGM was used. Hole punch positions were 11" and 28" from the low end of the ton and 28" from the high end of the ton.

A 10.16 gallon (84 pound) water spray, at a temperature of 122°F, was sprayed in the lower 28" hole. The spray wand cycle started at 22", down to 26.5" (hard stop), up to 10", down to 18", up to 10", and down to hard stop. After a fifteen minute soak time the drain tube was fully extended. It lowered to the 33.5" mark, two inches short of the bottom. The rinsate pump was started and a drain was conducted which pumped about 39 pounds of rinsate from the parent. This was less rinsate than the amount of water that had been added. The usual cycling of the drain tube up and down was performed but it had minimal effect.

A second spray was performed which consisted of 4.08 gallons (34 pounds) sprayed into the same lower 28" hole. An immediate drain was conducted from the 11" hole which removed 219 pounds of heel leaving a parent weight of 366 pounds and a child rinsate weight of 321 pounds. The heel to water ratio of this drain (with 2 sprays) was 1.9

A 10.43 gallon (86 pound) third spray, at a temperature of 124°F, was sprayed in the upper 28" hole. No soak time was used so the drain tube was lowered into the 11" hole. The drain tube lowered down to about the 34.5" depth where it seemed to have a slightly "soft" stop. The rinsate pump was started and a drain was conducted which removed another 94 pounds of heel thus reducing the parent weight to 272 pounds. As usual, the drain tube was raised and lowered a couple of times but it did not provide any significant benefit. The heel to water ratio of this third spray and 2nd drain was 1.1.

A post video was performed at this point. The video showed moderate amounts of heel in both high corners and a moderate amount around the edges and one corner on the low end. Some heel remained in the middle of the TC slightly up both walls near the top of the original heel line. Dud to the generally disperse nature of the heel, it was decided to not perform another spray and drain even though the child weight was not yet at 600 pounds as desired.

The net result of the three sprays and two drains was that 313 pounds of heel was removed yielding a final parent weight of 272 pounds and a final child weight of 513 pounds. With a total sprayed water volume of 24.67 gallons (204 pounds) a final heel to water ratio of 1.33 was achieved.

Analysis

As already proven, anytime additional heel beyond the design basis is attempted, a much lower heel to water ratio is achieved. This results in a difficult tradeoff between achieving the desired rinsate weight for the child, and a heel water ratio that is typical of expected operational results for the final system design. The first spray did not use enough water to mobilize the heel, by adding the 4 gallon second spray, significant heel was mobilized which resulted in a heel water ratio of 1.9 which is what we have grown to expect.

HRS Test #20 Daily Overview

October 27, 2007
Ton D# - 10679
Initial Heel Weight (after agent drain) – 799 pounds
Planned Spray – 18 gallons
Planned Spray temperature – 120°F
Planned Sequence – Spray with 15 minute soak time

This test was performed on a flat tray (TC not tilted) instead of the 4” tilted tray. This test has two objectives; gather another first spray data point for a large heel ton, and generate a heavy child TC in the 600 pound range. Accordingly two sprays were planned; one in the lower 28” hole, and a second in the upper 28” hole.
The test consisted of spraying 18 gallons of 120°F water in the low 28” hole followed by a 15 minute soak time and a drain. No additional sprays were necessary

First entry
The video of the inside of the parent ton showed two distinct heel distributions. The first was an evenly distributed flat layer along the bottom of the ton and the second was a sharp 45 degree ramp up the side that was evenly distributed along the length of the ton. Previous sloped heels were sloped continuously to the bottom of the ton and didn’t have the even flat heel across the bottom.

No strainer was installed. No CGM was used. Hole punch positions were 11” and 28” from the low end of the ton and 28” from the high end of the ton.

An 18.07 gallon (149 pound) water spray, at a temperature of 122°F, was sprayed in the lower 28” hole. The spray wand cycle started at 15”, down to 20”, up to 10”, down to 26.5”, up to 10”, down to 18”, up to 10” and down 26.5”. After a fifteen minute soak time the drain tube was fully extended. It lowered to the 35” mark, one-half inch short of the bottom. The rinsate pump was started and a drain was conducted which pumped 444 pounds of heel from the parent. The drain was stopped early due to a full Child TC. As a result of this single spray and drain the Parent was reduced to 355 pounds and the Child rinsate weight was 621 pounds. The heel to water ratio was 3.0.
A post video was performed at this point. The video showed all of heel removed in the spray zone and even further into the opposite end of the TC than previously seen. As expected due to stopping the drain process early, considerable liquid was still present in the bottom of the TC. Upon examination with a “dip stick”, there was approximately 4” of liquid remaining on the bottom of this flat tray ton container. Based upon this level over three-fourths the length of the ton, it is estimated that another 100 pounds of pumpable rinsate remained. If this rinsate had been pumped to a second child ton container, the actual heel to water ratio would have been around 3.7.

Analysis
The heel present in this TC clearly exhibited a different behavior. It was much more soluble and its appearance from the video was more snowy, or crystalline in nature.

Appendix E - HTS Data Sheets

DATA SHEET 2 – SIMULTANEOUS SPRAY AND DRAIN

Test Number TCT-01 **PSM Authorization** Gary

Reader/Checker S. Duncan **Date** 10-8-07

TD: T. Hutson D 79754

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	3.4.2	Y
CC	Combustible Gas Monitor Required (Yes or No)	3.13	Y
DD	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		
EE	Volume of Water To Be Added (gallons)	3.29.9	10

TEST DATA			
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data**
ZZ	"Tap" height of Top of Ton Container	1.6	30.78
A	Initial Heel Reference(10" hole)	1.13 / [ZZ - 8.46]	22.32
B	Pre-Spray Parent Weight	1.16.2	4453
C	Initial Heel Reference (27" hole)	1.20 / [ZZ - 7.68]	23.1
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 / [ZZ - 9.94]	20.84
E	Empty weight of Child TC (BDS-101 load cell)	3.7.2	3605
F	Initial Spray Wand Height	3.16 / [C] – 0.5"	22.6 ~23
G	Maximum Spray Wand Insertion height	3.29.2 / [C] + 4.5"	27.6 ~28
H	Drain Start Time	3.29.5	
J	Child TC Max Fill Weight	3.29.6.1 / [E] + [DD]	
K	Water Temperature at Spray Wand (TI-500)	3.29.8	122.5
L	Temperature at High Pressure Pump Outlet (TI-300)	3.29.8	121.9
M	Pressure at High Pressure Pump Outlet (PI-200)	3.29.8	2850
N	Water Flow Rate (FE-100)	3.29.8	2.87
O	Total Water Volume Added (FE-100 Totalizer)	3.29.10	15.61
P	Post Drain Parent Weight (BDS-102 Load Cell)	3.37.2	4327
Q	Child TC Final Weight (BDS-101 Load Cell)	3.38.2	3971
U	Child TC Rinsate Temperature	3.49	—
V	Child TC Rinsate pH	3.50	1.7/6.5
R	Child TC Rinsate Weight	3.52 / [Q] – [E]	366
S	Parent TC Heel Removed Weight	3.52 / [B] – [P]	126
T	Water Added Weight	3.52 / [R] – [S]	240(?)

Notes 15.6 gal x 8 = 124.8

+ Flush quantity ??

FM-SOP118-B.R0C2

DATA SHEET 2 – SIMULTANEOUS SPRAY AND DRAIN

Test Number TCT-02 **PSM Authorization** Gary Smith

Reader/Checker Stan Duncan **Date** 10-8-07

D- 94917

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	3.4.2	Y
CC	Combustible Gas Monitor Required (Yes or No)	3.13	Y
DD	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630 max
EE	Volume of Water To Be Added (gallons)	3.29.9	10

Initial Child Weight - 3612

TEST DATA			
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data**
ZZ	"Tap" height of Top of Ton Container	1.6	30.93
A	Initial Heel Reference(10" hole)	1.13 / [ZZ - 26.19]	4.74"
B	Pre-Spray Parent Weight	1.16.2	4629
C	Initial Heel Reference (27" hole)	1.20 / [ZZ - 10.56]	20.37
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 / [ZZ - 13.53]	17.4
E	Empty weight of Child TC (BDS-101 load cell)	3.7.2	3612
F	Initial Spray Wand Height	3.16 / [C] – 0.5"	20.00
G	Maximum Spray Wand Insertion height	3.29.2 / [C] + 4.5"	24.5
H	Drain Start Time	3.29.5	—
J	Child TC Max Fill Weight	3.29.6.1 / [E] + [DD]	630
K	Water Temperature at Spray Wand (TI-500)	3.29.8	124
L	Temperature at High Pressure Pump Outlet (TI-300)	3.29.8	126
M	Pressure at High Pressure Pump Outlet (PI-200)	3.29.8	2850
N	Water Flow Rate (FE-100)	3.29.8	2.85
O	Total Water Volume Added (FE-100 Totalizer)	3.29.10	10.24+10.21 = 20.45
P	Post Drain Parent Weight (BDS-102 Load Cell)	3.37.2	4316 (Final of 3)
Q	Child TC Final Weight (BDS-101 Load Cell)	3.38.2	4221 (final of 3)
U	Child TC Rinsate Temperature	3.49	—
V	Child TC Rinsate pH	3.50	—
R	Child TC Rinsate Weight	3.52 / [Q] – [E]	609
S	Parent TC Heel Removed Weight	3.52 / [B] – [P]	313
T	Water Added Weight	3.52 / [R] – [S]	296

Notes 2:45 soak after first rinse
TC # D- 94917
DCD Fill (net) wt 1783
≈ 922 lbs heel in Parent

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Appendix E - Data Sheet Test 3

DATA SHEET 2 – SIMULTANEOUS SPRAY AND DRAIN

Test Number TCT-03 **PSM Authorization** ____________

Reader/Checker Stan Duncan **Date** 10-10-07

D78719 Full Weight – 5670

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	3.4.2	Y
CC	Combustible Gas Monitor Required (Yes or No)	3.13	Y
DD	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630
EE	Volume of Water To Be Added (gallons)	3.29.9	10 gal

Child – 3877

TEST DATA				
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data**	
ZZ	"Tap" height of Top of Ton Container	1.6	30.66	
A	Initial Heel Reference(~~10~~" 11 hole)	1.13 / [ZZ - 9.43]	21.23	
B	Pre-Spray Parent Weight	1.16.2	4653	~~[illegible]~~ 4417
C	Initial Heel Reference (~~27~~" 28 hole)	1.20 / [ZZ - 6.14]	25.2	
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 / [ZZ - 11.3]	19.36	
E	Empty weight of Child TC (BDS-101 load cell)	3.7.2	3640	3962
F	Initial Spray Wand Height	3.16 / [C] – 0.5"	20	
G	Maximum Spray Wand Insertion height	3.29.2 / [C] + 4.5"	25	
H	Drain Start Time	3.29.5		
J	Child TC Max Fill Weight	3.29.6.1 / [E] + [DD]	4270	
K	Water Temperature at Spray Wand (TI-500)	3.29.8	126	129
L	Temperature at High Pressure Pump Outlet (TI-300)	3.29.8	126	131
M	Pressure at High Pressure Pump Outlet (PI-200)	3.29.8	2750	2750
N	Water Flow Rate (FE-100)	3.29.8	2.85	2.81
O	Total Water Volume Added (FE-100 Totalizer)	3.29.10	10.25	10.23
P	Post Drain Parent Weight (BDS-102 Load Cell)	3.37.2	4519	~~4463~~ 4330
Q	Child TC Final Weight (BDS-101 Load Cell)	3.38.2	3877 ✓	~~3884~~ 4141
U	Child TC Rinsate Temperature	3.49	—	X
V	Child TC Rinsate pH	3.50	—	X
R	Child TC Rinsate Weight	3.52 / [Q] – [E]	237	~~322~~ 179
S	Parent TC Heel Removed Weight	3.52 / [B] – [P]	134	~~234~~ 87
T	Water Added Weight	3.52 / [R] – [S]	103	92

After 1st afternoon drain; before afternoon spray.

Notes water added – 10.23
× 8
81.84

Total Heel Removed: 234+87 = 321 (lbs)
Total water added: 10.25+10.23 = 20.48 (gals) > 15 lbs/gal

steve Bailey x 7806

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DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

Test Number TCT-04 PSM Authorization ____________

Reader/Checker Stan Duncan Date 10.11.07

D78735

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	X
CC	Combustible Gas Monitor Required (Yes or No)	2.13	X
DD	Volume of Water To Be Added (gallons)	2.29	10
EE	Soak Time (minutes)	2.39	30
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630

Heel - 755

TEST DATA						
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data-1**	1443 Second **Data-2**	Second Rinse **Data-3**	Totals **Data-4**
ZZ	"Tap" height of Top of Ton Container	1.6	31.61	31.61	"	
A	Initial Heel Reference (10" hole)	1.13 / [ZZ - 8.54]	23.07	23.07	"	
B	Pre-Spray Parent Weight	1.16.2	~~4640~~	4640	4450	
C	Initial Heel Reference (27" hole)	1.20 [ZZ - 9.32]	22.29	22.29	"	
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - 10.52]	21.09	21.09	"	
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	3572	3572	3572	
F	Initial Spray Wand Height	2.16 / [C] - 0.5"	21.79		—	
G	Maximum Spray Wand Insertion Height	2.28.2 / [C] + 4.5"	26.79		—	
H	Water Temperature at Spray Wand (TI-500)	2.28.5	127		123	
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	127		125	
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5	2850		2850	
L	Water Flow Rate (FE-100)	2.28.5	2.86		2.86	
M	Total Water Volume Added (FE-100 Totalizer)	2.30	10.26		6.18	16.44
N	~~Soak Start Time~~	2.31				
O	Post-Spray Parent Weight	2.35	4699		4490	
W	Rinsate Temperature at beginning of Soak Time	2.38	93-94°		—	
X	Rinsate Temperature at end of Soak Time	2.41	—		—	
P	~~Drain Start Time/End~~ Soak Time	2.44	30 min		5 min	
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	4202		—	

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Gregg

DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

					Second	Total (1st & Second)
R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2	4520		4367	
Y	Child TC Rinsate Temperature	2.61	—		—	
Z	Child TC Rinsate pH	2.62	—		—	
S	Child TC Rinsate Weight	2.64 / [O] – [R]	179		123	Bad Data Point Discard.
T	Child TC Final Weight	2.64 / [E] + [S]	3251		~~4573~~ 4858	
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]	120		83	203 ← (120+83)
V	Water Added Weight	2.64 / [O] – [B]	59		40	

Notes Summary:

	1st	2nd	Total
Water	10.26	6.18	16.44
Heel Removed	120	83	203
Soak Time	30min	5min	

		T_1	T_2	T_3	T_4	
5*	LEL					
PID	VOC					
Reader Checker	Time					

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DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

Test Number TCT-05 **PSM Authorization** ______

Reader/Checker Stan Duncan Ikesley **Date** 10/12/07

D-17759

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	Y
CC	Combustible Gas Monitor Required (Yes or No)	2.13	Y
DD	Volume of Water To Be Added (gallons)	2.29	15
EE	Soak Time (minutes)	2.39	30 mins
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630

#5578 Heel = 660 (CON)

TEST DATA						
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data-1**	**Data-2**	**Data-3**	**Data-4**
ZZ	"Tap" height of Top of Ton Container	1.6	30.84			
A	Initial Heel Reference (10" hole)	1.13 / [ZZ - 9.26]	21.56			
B	Pre-Spray Parent Weight	1.16.2	4445			
C	Initial Heel Reference (27" hole)	1.20 [ZZ - 9.52]	21.32			
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - 10.9]	19.94			
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	3678			
F	Initial Spray Wand Height	2.16 / [C] - 0.5"	20.82			
G	Maximum Spray Wand Insertion Height	2.28.2 / [C] + 4.5"	25.82			
H	Water Temperature at Spray Wand (TI-500)	2.28.5	~~132~~ 122	126.5		
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	~~124~~ 125.3	128.7		
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5	2850	2850		
L	Water Flow Rate (FE-100)	2.28.5	2.86	2.83		
M	Total Water Volume Added (FE-100 Totalizer)	2.30	14.97			
~~N~~	~~Soak Start Time~~	~~2.31~~				
O	Post-Spray Parent Weight	2.35	4570			
W	Rinsate Temperature at beginning of Soak Time	2.38	161.7			
X	Rinsate Temperature at end of Soak Time	2.41	—	PROBE THROWN OUT		
P	~~Drain Start Time (E~~nd Soak Time)	2.44				
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	4908			

Strainer

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4908

DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2	~~[illegible]~~ 4192			
Y	Child TC Rinsate Temperature	2.61	——			
Z	Child TC Rinsate pH	2.62	—— 1.4/0.0			
S	Child TC Rinsate Weight	2.64 / [O] – [R]	378			
T	Child TC Final Weight	2.64 / [E] + [S]	4056			
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]	253			
V	Water Added Weight	2.64 / [O] – [B]	125			

660 - 253 = 407

Notes pH – RED = 1.4
GREEN = 0.0

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DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

Test Number TCT 06 **PSM Authorization** Scott Sorenson

Reader/Checker KESLEY **Date** 10/13/7

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	NO
CC	Combustible Gas Monitor Required (Yes or No)	2.13	~~NO~~ YES
DD	Volume of Water To Be Added (gallons)	2.29	7
EE	Soak Time (minutes)	2.39	30
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630

TEST DATA			
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data**
ZZ	"Tap" height of Top of Ton Container	1.6 8.58	~~30.83~~ 30.83
A	Initial Heel Reference (10" hole)	1.13 / [ZZ - ~~9.56~~]	22.25
B	Pre-Spray Parent Weight	1.16.2	4473
C	Initial Heel Reference (27" hole)	1.20 [ZZ - 7.51]	23.32
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - 8.89]	21.94
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	3600
F	Initial Spray Wand Height	2.16 / [C] - 0.5"	22.82
G	Maximum Spray Wand Insertion Height	2.28.2 / [C] + 4.5"	27.82
H	Water Temperature at Spray Wand (TI-500)	2.28.5	118/125
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	125.5/127.2
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5	2750
L	Water Flow Rate (FE-100)	2.28.5	2.86
M	Total Water Volume Added (FE-100 Totalizer)	2.30	7.03
N	~~Soak Start Time~~	2.31	———
O	Post-Spray Parent Weight	2.35	4547
W	Rinsate Temperature at beginning of Soak Time	2.38	———
X	Rinsate Temperature at end of Soak Time	2.41	———
P	Drain Start Time (End Soak Time)	2.44	———
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	~~4230~~ 4230
R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2	4312
Y	Child TC Rinsate Temperature	2.61	———
Z	Child TC Rinsate pH	2.62	———
S	Child TC Rinsate Weight	2.64 / [O] – [R]	235
T	Child TC Final Weight	2.64 / [E] + [S]	3835
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]	161
V	Water Added Weight	2.64 / [O] – [B]	74

92.3 (FOUND PROBE ABOUT 5 MIN. BEFORE END OF SOAK)

Notes TOX IN: ~~0852~~ 1147 CO: 5
O-#: O-14171 ALL OTHERS 0
HEEL WT: 572
NEW HEEL: 411

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Appendix E - Data Sheet Test 7

DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

Test Number TCT 7 **PSM Authorization** Scott Sorenson

Reader/Checker KESLER **Date** 10/14/7

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	NO
CC	Combustible Gas Monitor Required (Yes or No)	2.13	YES
DD	Volume of Water To Be Added (gallons)	2.29	~~13~~ 7
EE	Soak Time (minutes)	2.39	30
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630

TEST DATA				
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data**	
ZZ	"Tap" height of Top of Ton Container	1.6	~~3.38~~ 30.91	
A	Initial Heel Reference (10" hole)	1.13 / [ZZ - 10.41]	20.50	
B	Pre-Spray Parent Weight	1.16.2	4662/4549	REDRAINED PRIOR TO SPRAY
C	Initial Heel Reference (27" hole)	1.20 [ZZ - 7.75]	23.16	
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - 9.86]	21.05	
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	3556	
F	Initial Spray Wand Height	2.16 / [C] - 0.5"	22.66	
G	Maximum Spray Wand Insertion Height	2.28.2 / [C] + 4.5"	27.66	
H	Water Temperature at Spray Wand (TI-500)	2.28.5	NOT OPERATIONAL	(122, TI-400)
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	~~127~~ 125	
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5	~~785~~ 2850	
L	Water Flow Rate (FE-100)	2.28.5	2.9	
M	Total Water Volume Added (FE-100 Totalizer)	2.30	7.25	
N	~~Soak Start Time~~	2.31	—	
O	Post-Spray Parent Weight	2.35	4619	
W	Rinsate Temperature at beginning of Soak Time	2.38	93	
X	Rinsate Temperature at end of Soak Time	2.41	76.4 (?)	
P	~~Drain Start Time (End Soak Time)~~	2.44	—	
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	4186	
R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2	4508	
Y	Child TC Rinsate Temperature	2.61	—	
Z	Child TC Rinsate pH	2.62	—	
S	Child TC Rinsate Weight	2.64 / [O] – [R]	111	
T	Child TC Final Weight	2.64 / [E] + [S]	3667	(3635)
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]	41	
V	Water Added Weight	2.64 / [O] – [B]	70	

Notes TOX IN: 1009 / 1453 — O_2: 20.5
D-#: 0-36831 — CO: 25 / 0
HEEL WT: 717 [(717-490)/2] / 8.3 = 13.7 gal — COMB.: 0 / 0
604 [(604-490)/2] / 8.3 = 7 gal — (18.5 MINUTES)
604-41 = 563

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DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

Test Number TCT 8 **PSM Authorization** [signature]

Reader/Checker KESLEY **Date** 10-15-7

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	NO
CC	Combustible Gas Monitor Required (Yes or No)	2.13	NO
DD	Volume of Water To Be Added (gallons)	2.29	12
EE	Soak Time (minutes)	2.39	30
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630

TEST DATA			
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data**
ZZ	"Tap" height of Top of Ton Container	1.6	30.84
A	Initial Heel Reference (10" hole)	1.13 / [ZZ - 9.03]	21.81
B	Pre-Spray Parent Weight	1.16.2	4527
C	Initial Heel Reference (27" hole)	1.20 [ZZ - 9.94]	20.90
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - 10.91]	19.93
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	3657
F	Initial Spray Wand Height	2.16 / [C] - 0.5"	20.40
G	Maximum Spray Wand Insertion Height	2.28.2 / [C] + 4.5"	25.40
H	Water Temperature at Spray Wand (TI-~~500~~ 400)	2.28.5	122 / 125.9
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	127.4
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5	2850
L	Water Flow Rate (FE-100)	2.28.5	2.85
M	Total Water Volume Added (FE-100 Totalizer)	2.30	12.23
N	~~Soak Start Time~~	2.31	——— (1013)
O	Post-Spray Parent Weight	2.35	4671
W	Rinsate Temperature at beginning of Soak Time	2.38	98.2
X	Rinsate Temperature at end of Soak Time	2.41	98.3
P	~~Drain Start Time (End Soak Time~~)	2.44	———
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	4287
R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2	~~4363~~ 4345
Y	Child TC Rinsate Temperature	2.61	———
Z	Child TC Rinsate pH	2.62	———
S	Child TC Rinsate Weight	2.64 / [O] – [R]	~~0348~~ 326 ~~(4000)~~ (4018)
T	Child TC Final Weight	2.64 / [E] + [S]	~~3965~~ 3983
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]	~~164~~ 182
V	Water Added Weight	2.64 / [O] – [B]	144

Notes TOX IN: 0939
O- #: O-85695
HEEL WT: 664
NEW HEEL: ~~500~~ 482

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Appendix E - Data Sheet Test 9

DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

Test Number TCT Ø9 **PSM Authorization** [signature]

Reader/Checker KESLEY **Date** 1Ø-16-7

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	NO
CC	Combustible Gas Monitor Required (Yes or No)	2.13	NO
DD	Volume of Water To Be Added (gallons)	2.29	14 / 4
EE	Soak Time (minutes)	2.39	3Ø
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		63Ø

TEST DATA			
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data**
ZZ	"Tap" height of Top of Ton Container	1.6	3Ø.85
A	Initial Heel Reference (10" hole)	1.13 / [ZZ - 9.86]	2Ø.99
B	Pre-Spray Parent Weight	1.16.2	4613
C	Initial Heel Reference (27" hole)	1.20 [ZZ - 11.Ø9]	19.76
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - 21.2Ø]	9.65*
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	~~[illegible]~~ 3577
F	Initial Spray Wand Height	2.16 / [C] - 0.5"	19.26
G	Maximum Spray Wand Insertion Height	2.28.2 / [C] + 4.5"	24.26
H	Water Temperature at Spray Wand (TI-~~500~~ 4ØØ)	2.28.5	124 / 126.9
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	128.3 / 129
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5	285Ø
L	Water Flow Rate (FE-100)	2.28.5	2.86
M	Total Water Volume Added (FE-100 Totalizer)	2.30	14.14 / 4.16
N	~~Soak Start Time~~	2.31	—
O	Post-Spray Parent Weight	2.35	474Ø / 4443
W	Rinsate Temperature at beginning of Soak Time	2.38	97.5
X	Rinsate Temperature at end of Soak Time	2.41	97.7
P	~~Drain Start Time (End Soak Time)~~	2.44	—
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	42Ø7 /
R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2	44Ø9 / 4357 / 434Ø
Y	~~Child TC Rinsate Temperature~~	2.61	—
Z	~~Child TC Rinsate pH~~	2.62	—
S	Child TC Rinsate ~~Weight~~	2.64 / [O] – [R]	331 / 86 / 17 = $\boxed{434}$
T	Child TC Final Weight	2.64 / [E] + [S]	39Ø8 / 3994 / 4Ø11 (3895) / (3998)
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]	2Ø4 / ~~[illegible]~~ 52 / 17 = $\boxed{273}$ (4Ø16)
V	Water Added Weight	2.64 / [O] – [B]	127 / 34 / ~~[illegible]~~ = $\boxed{1161}$

* HIT EDUCTOR TUBE

Notes TOX IN : 4841 / 143Ø
D- # : 0-8273Ø
HEEL WT : 755
NEW HEEL WT : 551 / 499 / 482
~~[illegible]~~:

FM-SOP118-A.R0C2

DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

Test Number TCT 10 **PSM Authorization** [illegible]

Reader/Checker KESLEY **Date** 10-17-7

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	NO
CC	Combustible Gas Monitor Required (Yes or No)	2.13	NO
DD	Volume of Water To Be Added (gallons)	2.29	16
EE	Soak Time (minutes)	2.39	30
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630

TEST DATA			
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data**
ZZ	"Tap" height of Top of Ton Container	1.6	31.51
A	Initial Heel Reference (10" hole)	1.13 / [ZZ - 10.17]	21.34
B	Pre-Spray Parent Weight	1.16.2	4643
C	Initial Heel Reference (27" hole)	1.20 [ZZ - 11.24]	~~[illegible]~~ 20.27
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - 12.07]	19.44
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	3618
F	Initial Spray Wand Height	2.16 / [C] - 0.5"	19.77
G	Maximum Spray Wand Insertion Height	2.28.2 / [C] + 4.5"	24.77
H	Water Temperature at Spray Wand (TI-~~5~~700)	2.28.5	120.0 / 126.5
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	122.3 / 127.8
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5	2850
L	Water Flow Rate (FE-100)	2.28.5	2.83
M	Total Water Volume Added (FE-100 Totalizer)	2.30	16.23
N	Soak Start Time	2.31	1022
O	Post-Spray Parent Weight	2.35	4791
W	Rinsate Temperature at beginning of Soak Time	2.38	100.3
X	Rinsate Temperature at end of Soak Time	2.41	100.0
P	Drain Start Time (End Soak Time)	2.44	1052
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	4248
R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2	4370
Y	Child TC Rinsate Temperature	2.61	——
Z	Child TC Rinsate pH	2.62	——
S	Child TC Rinsate Weight	2.64 / [O] – [R]	421
T	Child TC Final Weight	2.64 / [E] + [S]	4039 (4023)
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]	273
V	Water Added Weight	2.64 / [O] – [B]	148

Notes TOX IN : 0949
D- # : D-17288
HEEL WT : 733
NEW HEEL WT : 460
~~[illegible]~~:

FM-SOP118-A.R0C2

DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

Test Number TCT 11 **PSM Authorization** Robert Porter

Reader/Checker VESCEY **Date** 1Ø-18-7

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	NO
CC	Combustible Gas Monitor Required (Yes or No)	2.13	NO
DD	Volume of Water To Be Added (gallons)	2.29	16 / 4 / Ø /2
EE	Soak Time (minutes)	2.39	3Ø
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		63Ø

TEST DATA			
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data**
ZZ	"Tap" height of Top of Ton Container	1.6	3Ø.72
A	Initial Heel Reference (10" hole)	1.13 / [ZZ - 8.46]	22.26
B	Pre-Spray Parent Weight	1.16.2	4572
C	Initial Heel Reference (27" hole)	1.20 [ZZ - 8.95]	21.77
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - 1Ø.46]	2Ø.26
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	3552
F	Initial Spray Wand Height	2.16 / [C] - 0.5"	21.27
G	Maximum Spray Wand Insertion Height +1	2.28.2 / [C] + 4.5"	26.27
H	Water Temperature at Spray Wand (TI-~~500~~6Ø0)	2.28.5	122.5 / 126.3
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	127 / 122[illegible]
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5	285Ø
L	Water Flow Rate (FE-100)	2.28.5	2.89
M	Total Water Volume Added (FE-100 Totalizer)	2.30	16.2 / 4.22 / Ø / 2.24
N	Soak Start Time	2.31	—
O	Post-Spray Parent Weight	2.35	4717 / 438Ø / / 4295
W	Rinsate Temperature at beginning of Soak Time	2.38	—
X	Rinsate Temperature at end of Soak Time	2.41	—
P	Drain Start Time (End Soak Time)	2.44	—
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	4182 /
R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2	~~[illegible]~~ 4341 / 4293 / 4278 / 4266
Y	Child TC Rinsate Temperature	2.61	—
Z	Child TC Rinsate pH	2.62	—
S	Child TC Rinsate Weight	2.64 / [O] – [R]	376 / 87 / 15 / 29 = $\boxed{5Ø7}$
T	Child TC Final Weight	2.64 / [E] + [S]	3928 / 4Ø15 / 403Ø / 4Ø59 (4Ø7Ø)
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]	231 / 48 / 15 / 12 = $\boxed{3Ø6}$
V	Water Added Weight	2.64 / [O] – [B]	145 / 39 / Ø / 17 = $\boxed{2Ø1}$

Notes TOX IN: Ø949 / 1424 CONCENTRATED ON SPRAYING FROM TOP OF STROKE

D- # : 32252

HEEL WT: 795

NEW HEEL WT: 564 / 516 / 5Ø1 / 489

[illegible]:

FM-SOP118-A.R0C2 SPRAY SOAK DRAIN / SPRAY DRAIN / DRAIN / SPRAY DRAIN

DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

Test Number TCT 12 PSM Authorization [illegible]

Reader/Checker KESLEY Date 10-19-7

TEST PARAMETERS			
Ref. ID	Description	Reference Step	Value
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	NO
CC	Combustible Gas Monitor Required (Yes or No)	2.13	YES
DD	Volume of Water To Be Added (gallons)	2.29	16/8
EE	Soak Time (minutes)	2.39	~~30~~ 25/~~[illegible]~~ 15
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630

TEST DATA			
Ref. ID	Description	Ref. Step / Calculation	Data
ZZ	"Tap" height of Top of Ton Container	1.6	29.39
A	Initial Heel Reference (10" hole)	1.13 / [ZZ - 8.66]	20.73
B	Pre-Spray Parent Weight	1.16.2	4360
C	Initial Heel Reference (27" hole)	1.20 [ZZ - 9.09]	20.30
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - ENVCT]	———
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	3568/
F	Initial Spray Wand Height	2.16 / [C] - 0.5"	19.80
G	Maximum Spray Wand Insertion Height	2.28.2 / [C] + 4.5"	24.80
H	Water Temperature at Spray Wand (TI-~~500~~ 400)	2.28.5	137.3 / 123 / 126
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5	
L	Water Flow Rate (FE-100)	2.28.5	
M	Total Water Volume Added (FE-100 Totalizer)	2.30	8.44/8.25
N	Soak Start Time	2.31	———
O	Post-Spray Parent Weight	2.35	4465 / 4523
W	Rinsate Temperature at beginning of Soak Time	2.38	104 /
X	Rinsate Temperature at end of Soak Time	2.41	———
P	Drain Start Time (End Soak Time)	2.44	———
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	4198
R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2	4141
Y	Child TC Rinsate Temperature	2.61	———
Z	Child TC Rinsate pH	2.62	———
S	Child ~~T~~C Rinsate Weight	2.64 / [O] – [R]	382
T	Child TC Final Weight	2.64 / [E] + [S]	3950 (3922)
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]	~~[illegible]~~ 219
V	Water Added Weight	2.64 / [O] – [B]	85 / 58 $\boxed{163}$

Notes TOX IN: 0949 / 1458 THIS IS ON A FLAT TRAY

D- # : 0-82461 MIN. INSERTION = 14"

HEEL WT: ~~[illegible]~~ 730 HIGH LEL ALARM 10% (12 SPRAY)

NEW HEEL WT: ~~491~~ 511 WATCH LEL AND STOP @ 40%

~~[illegible]~~: 2ND ENTRY HIT 20.4%

FM-SOP118-A.R0C2

DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

Test Number TCT 13 **PSM Authorization** [signature]

Reader/Checker KESLEY **Date** 10-20-7

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	NO
CC	Combustible Gas Monitor Required (Yes or No)	2.13	NO
DD	Volume of Water To Be Added (gallons)	2.29	12
EE	Soak Time (minutes)	2.39	30
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630

TEST DATA			
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data**
ZZ	"Tap" height of Top of Ton Container	1.6	30.52
A	Initial Heel Reference (10" hole)	1.13 / [ZZ - 9.39]	21.13
B	Pre-Spray Parent Weight	1.16.2	4541
C	Initial Heel Reference (27" hole)	1.20 [ZZ - 10.38]	20.14
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - 19.88]	10.64 HIT EDUCTOR
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	3646
F	Initial Spray Wand Height	2.16 / [C] - 0.5"	19.64
G	Maximum Spray Wand Insertion Height	2.28.2 / [C] + 4.5"	24.64
H	Water Temperature at Spray Wand (TI-500)	2.28.5	116/127/127.5
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	122.9/128.8/129.1
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5	2850
L	Water Flow Rate (FE-100)	2.28.5	2.86
M	Total Water Volume Added (FE-100 Totalizer)	2.30	12.21
N	Soak Start Time	2.31	0944
O	Post-Spray Parent Weight	2.35	4654
W	Rinsate Temperature at beginning of Soak Time	2.38	97.5
X	Rinsate Temperature at end of Soak Time	2.41	——
P	Drain Start Time (End Soak Time)	2.44	1013
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	4276
R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2	4342
Y	Child TC Rinsate Temperature	2.61	——
Z	Child TC Rinsate pH	2.62	——
S	Child TC Rinsate Weight	2.64 / [O] – [R]	312
T	Child TC Final Weight	2.64 / [E] + [S]	3958 (3937)
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]	199
V	Water Added Weight	2.64 / [O] – [B]	113

Notes TOX IN: 0853 COMB: 3%@5, 4%@7.5, 5%@10
D-# : 81158 SUCKED UP SAMPLING DEBRIS, PLUGGED DRAIN TUBE
HEEL WT: 651
NEW HEEL: 452

FM-SOP118-A.R0C2

Appendix E - Data Sheet Test 14

DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

Test Number TCT 14 **PSM Authorization** [signature]

Reader/Checker WESLEY W KIMMELL **Date** 10-21-7

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	NO
CC	Combustible Gas Monitor Required (Yes or No)	2.13	NO
DD	Volume of Water To Be Added (gallons)	2.29	12
EE	Soak Time (minutes)	2.39	30
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630

TEST DATA			
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data**
ZZ	"Tap" height of Top of Ton Container	1.6	30.68
A	Initial Heel Reference (10" hole)	1.13 / [ZZ - 9.42]	21.24
B	Pre-Spray Parent Weight	1.16.2	4586
C	Initial Heel Reference (27" hole)	1.20 [ZZ - 9.02]	21.66
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - 10.53]	20.15
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	3550
F	Initial Spray Wand Height	2.16 / [C] - 0.5"	21.16
G	Maximum Spray Wand Insertion Height	2.28.2 / [C] + 4.5"	26.16
H	Water Temperature at Spray Wand (TI-~~500~~ 4)	2.28.5	101 / 108
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5	
L	Water Flow Rate (FE-100)	2.28.5	
M	Total Water Volume Added (FE-100 Totalizer)	2.30	12.24
N	Soak Start Time	2.31	—
O	Post-Spray Parent Weight	2.35	4711
W	Rinsate Temperature at beginning of Soak Time	2.38	91.5
X	Rinsate Temperature at end of Soak Time	2.41	—
P	Drain Start Time (End Soak Time)	2.44	—
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	4180
R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2	4547 / 4388
Y	Child TC Rinsate Temperature	2.61	—
Z	Child TC Rinsate pH	2.62	—
S	Child TC Rinsate Weight	2.64 / [O] – [R]	~~323~~ 164 / 159 = $\boxed{323}$
T	Child TC Final Weight	2.64 / [E] + [S]	3873 (3869)
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]	39 / 159 = $\boxed{198}$
V	Water Added Weight	2.64 / [O] – [B]	125

Notes TOX IN: 0845 DIFFICULTY PUMPING RINSATE
D- # : D-43499 SECOND DRAINS WERE FROM SPRAY HOSE
HEEL WT: 657
NEW HEEL WT: 459
~~[illegible]~~:

FM-SOP118-A.R0C2

DATA SHEET 1 – SPRA)LLOWED BY SOAK TIME

Test Number TCT-015 **PSM Authorization** ____________

Reader/Checker Duncan/Hutson D7107 **Date** 10-22-07

Heel 5

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	N
CC	Combustible Gas Monitor Required (Yes or No)	2.13	Y
DD	Volume of Water To Be Added (gallons)	2.29	6 gallon/2/2
EE	Soak Time (minutes)	2.39	20 min/0-second/0-third
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630

TEST DATA						
Ref. ID	**Description**	**Ref. Step / Calculation**	First Spray **Data-1**	Second Spray **Data-2**	Third Spray **Data-3**	Total ~~**Data-4**~~
ZZ	"Tap" height of Top of Ton Container	1.6	30.5			
A	Initial Heel Reference (1st" hole)	1.13 / [ZZ - ________]				
B	Pre-Spray Parent Weight	1.16.2 4472	~~3578~~			
C	Initial Heel Reference (2nd" hole)	1.20 [ZZ - ________]				
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - ________]				
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	3578			
F	Initial Spray Wand Height	2.16 / [C] - 0.5"				
G	Maximum Spray Wand Insertion Height	2.28.2 / [C] + 4.5"				
H	Water Temperature at Spray Wand (TI-500)	2.28.5	122			
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	122.7	119	117	
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5	2850	2850	2850	
L	Water Flow Rate (FE-100)	2.28.5	2.86	2.86	2.86	
M	Total Water Volume Added (FE-100 Totalizer)	2.30	6.22	2.17	~~2.19~~	10.58 (87.3 lbs)
N	Soak ~~Start~~ Time 0953	2.31	20			
O	Post-Spray Parent Weight	2.35	4553	4571	4589	
W	~~Rinsate Temperature at beginning of Soak Time~~	2.38	—			
X	~~Rinsate Temperature at end of Soak Time~~	2.41	—			
P	~~Drain Start Time (End Soak Time)~~	2.44	—			
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	4208			

FM-SOP118-A.R0C2

TCT-015
10·21·07

DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2			4225	
Y	~~Child TC Rinsate Temperature~~	2.61			—	
Z	~~Child TC Rinsate pH~~	2.62			—	
S	~~Child TC Rinsate Weight~~	2.64 / [O] – [R]			364	
T	Child TC Final Weight	2.64 / [E] + [S]			3942	
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]			247	
V	Water Added Weight	2.64 / [O] – [B]			117	

Notes

FM-SOP118-A.R0C2

DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

Test Number TCT 16 **PSM Authorization** Scott Sorenson

Reader/Checker KESLEY **Date** 10-23-7

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	NO
CC	Combustible Gas Monitor Required (Yes or No)	2.13	YES
DD	Volume of Water To Be Added (gallons)	2.29	14 / 7
EE	Soak Time (minutes)	2.39	~~30~~ 15/3
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630

TEST DATA				
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data**	
ZZ	"Tap" height of Top of Ton Container	1.6	~~30.87~~	
A	Initial Heel Reference (10" hole)	1.13 / [ZZ - ~~6.55~~]	~~24.32~~	
B	Pre-Spray Parent Weight	1.16.2	4315 / 4110	
C	Initial Heel Reference (27" hole)	1.20 [ZZ - ~~5.98~~]	~~24.89~~	
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - ~~6.25~~]	~~24.62~~	
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	3669 / 4008	
F	Initial Spray Wand Height	2.16 / [C] - 0.5"	~~24.39~~	
G	Maximum Spray Wand Insertion Height	2.28.2 / [C] + 4.5"	29.39	
H	Water Temperature at Spray Wand (TI-~~500~~ 400)	2.28.5	121 / 125 /	127
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	123 /	
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5		
L	Water Flow Rate (FE-100)	2.28.5		
M	Total Water Volume Added (FE-100 Totalizer)	2.30	14.12 / 7.08	
N	Soak Start Time	2.31	——	
O	Post-Spray Parent Weight	2.35	4449 / 4168	
W	Rinsate Temperature at beginning of Soak Time	2.38	——	
X	Rinsate Temperature at end of Soak Time	2.41	——	
P	Drain Start Time (End Soak Time)	2.44	——	
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	4299 /	
R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2	4110 / 3992	/ 3983
Y	Child TC Rinsate Temperature	2.61	——	
Z	Child TC Rinsate pH	2.62	——	
S	Child TC Rinsate Weight	2:64 / [O] – [R]	339 / 176	= ~~$\boxed{507}$~~ $\boxed{515}$ + 9 = $\boxed{524}$
T	Child TC Final Weight	2.64 / [E] + [S]	4008 / 4184	/ 4192
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]	205 / 118	= $\boxed{323}$ + 9 = $\boxed{332}$
V	Water Added Weight	2.64 / [O] – [B]	134 / 58	= $\boxed{192}$

Notes TOX IN: 0853 / ~~1450~~ 1448 NO TAP DATA, FLAT TRAY

D-# : D-92896 LEL: BATT. DIED ON BOTH OPERATIONAL 3 STARS

HEEL WT: ~~754~~ 691 1st ENTRY - 2 SPRAY + DRAINS

NEW HEEL WT: 486/368/359 2nd ENTRY - EXTRA DRAIN (9 POUNDS)

~~[illegible]~~:

FM-SOP118-A.R0C2

DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

Test Number TCT 17 **PSM Authorization** [signature]

Reader/Checker WESLEY **Date** 10-24-7

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	NO
CC	Combustible Gas Monitor Required (Yes or No)	2.13	NO
DD	Volume of Water To Be Added (gallons)	2.29	7/7/7/4
EE	Soak Time (minutes)	2.39	0
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630

TEST DATA			
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data**
ZZ	"Tap" height of Top of Ton Container	1.6	30.99
A	Initial Heel Reference (10" hole)	1.13 / [ZZ - 9.27]	21.72
B	Pre-Spray Parent Weight	1.16.2	~~4562~~ 4535 / 4401/4306 /4217
C	Initial Heel Reference (27" hole)	1.20 [ZZ - 8.54]	22.45
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - 10.30]	20.69
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	3565/3760/ 3922/4065
F	Initial Spray Wand Height	2.16 / [C] - 0.5"	21.95
G	Maximum Spray Wand Insertion Height	2.28.2 / [C] + 4.5"	26.95
H	Water Temperature at Spray Wand (TI-~~6~~400)	2.28.5	120.3/120.9/ 124.0
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5	
L	Water Flow Rate (FE-100)	2.28.5	
M	Total Water Volume Added (FE-100 Totalizer)	2.30	7.13/7.12/ 7.07/4.07 = $\boxed{25.39}$
N	Soak Start Time	2.31	
O	Post-Spray Parent Weight	2.35	4596/4463/4360/4245
W	Rinsate Temperature at beginning of Soak Time	2.38	—
X	Rinsate Temperature at end of Soak Time	2.41	—
P	Drain Start Time (End Soak Time)	2.44	—
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	4195
R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2	4401 /4306/ ~~[illegible]~~ 4217 /4178
Y	Child TC Rinsate Temperature	2.61	—
Z	Child TC Rinsate pH	2.62	—
S	Child TC Rinsate Weight	2.64 / [O] – [R]	195 /162/ ~~[illegible]~~ 143/67 = $\boxed{567}$
T	Child TC Final Weight	2.64 / [E] + [S]	3760/3922/ 4065 / 4132
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]	134/ 95 / 89 / 39 = $\boxed{357}$
V	Water Added Weight	2.64 / [O] – [B]	61/67 /54/ 28 = $\boxed{210}$

2.2/ 1.4/ 1.6 / 1.4 1.7

Notes TOX IN : 1353

D- # : D-81352

HEEL WT : ~~623~~ 596

NEW HEEL WT : 462/367/278/239

~~[illegible]~~:

FM-SOP118-A.R0C2

DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

Test Number TCT 18 **PSM Authorization** Robert Potter

Reader/Checker WESLEY **Date** 10-25-7

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	NO
CC	Combustible Gas Monitor Required (Yes or No)	2.13	~~YES~~ NO
DD	Volume of Water To Be Added (gallons)	2.29	10 + 10 / 5
EE	Soak Time (minutes)	2.39	015
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630

TEST DATA			
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data**
ZZ	"Tap" height of Top of Ton Container	1.6	30.96
A	Initial Heel Reference (10" hole)	1.13 / [ZZ - 8.64]	22.32
B	Pre-Spray Parent Weight	1.16.2	4413/4183
C	Initial Heel Reference (27" hole)	1.20 [ZZ - 7.94]	23.02
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - ———]	———
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	3593/4016
F	Initial Spray Wand Height	2.16 / [C] - 0.5"	22.52
G	Maximum Spray Wand Insertion Height	2.28.2 / [C] + 4.5"	27.52
H	Water Temperature at Spray Wand (TI-~~500~~ 400)	2.28.5	121 / 126.9 / 123.5 / 126
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5	
L	Water Flow Rate (FE-100)	2.28.5	
M	Total Water Volume Added (FE-100 Totalizer)	2.30	10.04 / 10.07 / 5.12
N	Soak Start Time	2.31	———
O	Post-Spray Parent Weight	2.35	4606/4232
W	Rinsate Temperature at beginning of Soak Time	2.38	———
X	Rinsate Temperature at end of Soak Time	2.41	———
P	Drain Start Time (End Soak Time)	2.44	———
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	4223
R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2	4183/4133
Y	Child TC Rinsate Temperature	2.61	———
Z	Child TC Rinsate pH	2.62	———
S	Child TC Rinsate Weight	2.64 / [O] – [R]	423 / 99 = $\boxed{522}$
T	Child TC Final Weight	2.64 / [E] + [S]	4016 / 4115
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]	230 / 50 = $\boxed{280}$
V	Water Added Weight	2.64 / [O] – [B]	193/49 = $\boxed{242}$

Notes TOX IN: 0903
D- # : D-17830
HEEL WT: 545
NEW HEEL WT: 315/265
[illegible]:

FM-SOP118-A.R0C2

DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

Test Number TCT 19 **PSM Authorization** ____________________

Reader/Checker KESLER **Date** 10-26-7

TEST PARAMETERS			
Ref. ID	**Description**	**Reference Step**	**Value**
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	NO
CC	Combustible Gas Monitor Required (Yes or No)	2.13	NO
DD	Volume of Water To Be Added (gallons)	2.29	10/~~[illegible]~~4/10
EE	Soak Time (minutes)	2.39	15
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630

TEST DATA				
Ref. ID	**Description**	**Ref. Step / Calculation**	**Data**	
ZZ	"Tap" height of Top of Ton Container	1.6	31.44	
A	Initial Heel Reference (10" hole)	1.13 / [ZZ - 9.19]	22.25	
B	Pre-Spray Parent Weight	1.16.2	4508/4523/	~~[illegible]~~ 4289
C	Initial Heel Reference (27" hole)	1.20 [ZZ - 8.56]	22.88	
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - 8.46]	22.98	
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	3610/3702	/3984
F	Initial Spray Wand Height	2.16 / [C] - 0.5"	23.38	
G	Maximum Spray Wand Insertion Height	2.28.2 / [C] + 4.5"	28.38	
H	Water Temperature at Spray Wand (TI-~~500~~400)	2.28.5	120.3/124.3/	118
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	122.1/126.7/	123.9
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5	2850	
L	Water Flow Rate (FE-100)	2.28.5	2.82 /2.80	
M	Total Water Volume Added (FE-100 Totalizer)	2.30	10.16/4.08/10.43	= $\boxed{24.67}$
N	Soak Start Time	2.31	1004 /	
O	Post-Spray Parent Weight	2.35	4615/4361/4399	
W	Rinsate Temperature at beginning of Soak Time	2.38	———	
X	Rinsate Temperature at end of Soak Time	2.41	———	
P	Drain Start Time (End Soak Time)	2.44	1019/	
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	4240	
R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2	4523/4289/	4195
Y	Child TC Rinsate Temperature	2.61	———	
Z	Child TC Rinsate pH	2.62	———	
S	Child TC Rinsate Weight	2.64 / [O] – [R]	92/272/204	= $\boxed{568}$
T	Child TC Final Weight	2.64 / [E] + [S]	3702/3984/4188	
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]	-15/234/94	= $\boxed{313}$
V	Water Added Weight	2.64 / [O] – [B]	107/38/110	= $\boxed{255}$

Notes TOX IN: ~~D-52455~~ 0928 — 1ST SPRAY – 10 GAL W/ 15 MIN SOAK 28" HOLE

D-# : ~~585~~ D-52455 — 2ND – 4 GAL W/ NO SOAK 28" HOLE

HEEL WT: 585 — 3RD – 10 GAL W/ NO SOAK WEST HOLE

NEW HEEL WT: 600/366/~~272~~

~~[illegible]~~: 272

FM-SOP118-A.R0C2

DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

Test Number TCT-020 PSM Authorization ____________ FLAT TRAY

Reader/Checker Duncan/Hutson Date 10·27·07
D-10679

Heel wt: 799

TEST PARAMETERS			
Ref. ID	Description	Reference Step	Value
AA	Number of holes to be punched for test (Usually 2)	1.17	3
BB	Child TC Strainer Required (Yes or No)	2.4.2	N
CC	Combustible Gas Monitor Required (Yes or No)	2.13	N
DD	Volume of Water To Be Added (gallons)	2.29	18
EE	Soak Time (minutes)	2.39	15
FF	Child TC Rinsate Weight (Maximum 630 pounds, may be unspecified)		630

TEST DATA			First Spray	Second Spray		
Ref. ID	Description	Ref. Step / Calculation	Data-1	Data-2	Data-3	Data-4
ZZ	"Tap" height of Top of Ton Container	1.6	29.13"			
A	Initial Heel Reference (10" hole) FLAT TRAY	1.13 / [ZZ - 9.01]	20.12"			
B	Pre-Spray Parent Weight	1.16.2	4464			
C	Initial Heel Reference (27" hole)	1.20 [ZZ - 13.21]	15.92			
D	Initial Heel Reference (3rd hole, if req.)	1.22.2 [ZZ - 17.35]	~~20"~~ 11.78			
E	Empty weight of Child TC (BDS-101 load cell)	2.7.2	3580			
F	Initial Spray Wand Height	2.16 / [C] - 0.5"	15"			
G	Maximum Spray Wand Insertion Height	2.28.2 / [C] + 4.5"	20"			
H	Water Temperature at Spray Wand (TI-500)	2.28.5	125			
J	Temperature at High Pressure Pump Outlet (TI-300)	2.28.5	126			
K	Pressure at High Pressure Pump Outlet (PI-200)	2.28.5	2850			
L	Water Flow Rate (FE-100)	2.28.5	2.82			
M	Total Water Volume Added (FE-100 Totalizer)	2.30	18.07			
N	Soak ~~Start~~ Time	2.31	15			
O	Post-Spray Parent Weight	2.35	4641			
W	Rinsate Temperature at beginning of Soak Time	2.38	—			
X	Rinsate Temperature at end of Soak Time	2.41	—			
P	Drain Start Time (End Soak Time)	2.44	—			
Q	Child TC Max Fill Weight	2.45.1 / [E] + [FF]	4210			

TON FULL WT = 5367

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4020 TCT-020 10-27-07

DATA SHEET 1 – SPRAY FOLLOWED BY SOAK TIME

R	Post Drain Parent Weight (BDS-102 Load Cell)	2.49.2	~~4209~~			
Y	Child TC Rinsate Temperature	2.61	—			
Z	Child TC Rinsate pH	2.62	—			
S	Child TC Rinsate Weight	2.64 / [O] – [R]	~~Ob~~ 621			
T	Child TC Final Weight	2.64 / [E] + [S]	4201			
U	Parent TC Heel Removed Weight	2.64 / [B] – [R]	444			
V	Water Added Weight	2.64 / [O] – [B]	177			

Notes Final Child wt - 4209
Dipsticked drain hole - 3-4 inches of liquid left

18.07
x 8.25
149 # H_2O

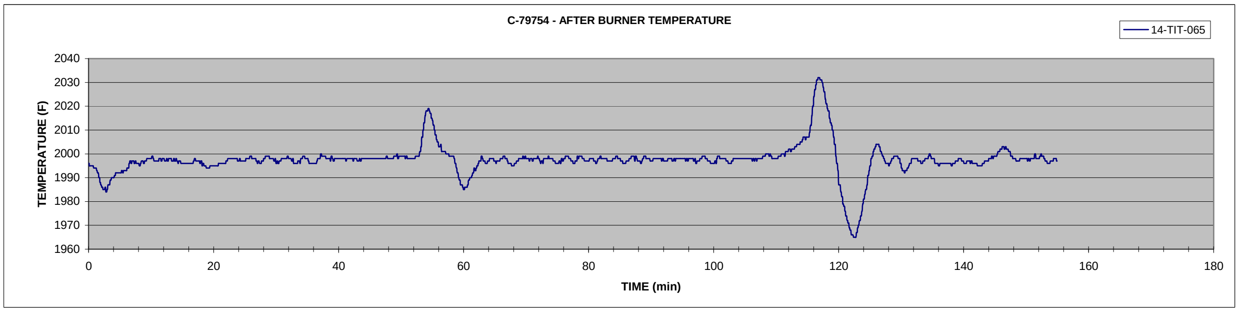
$\frac{444}{149} = 2.98$

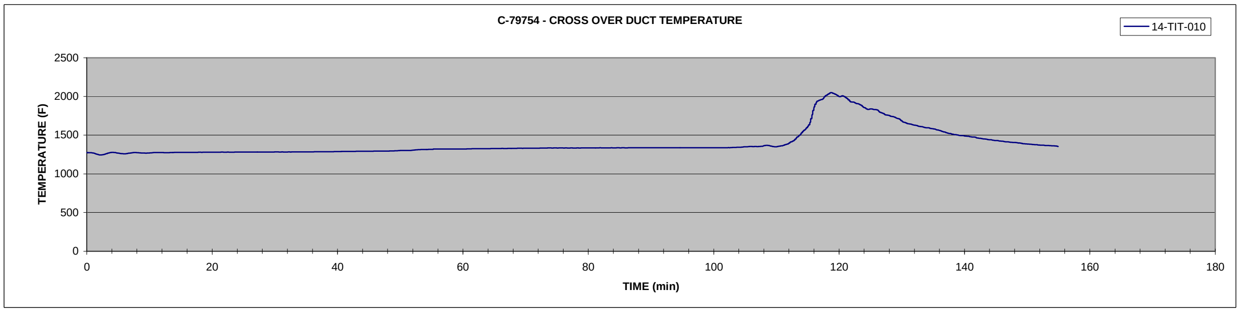
FM-SOP118-A.R0C2

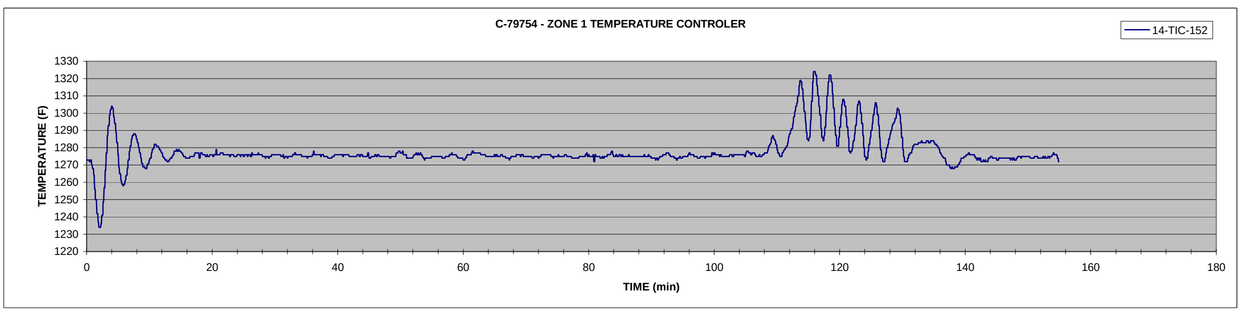
Appendix F - MPF Child TC Data Graphs

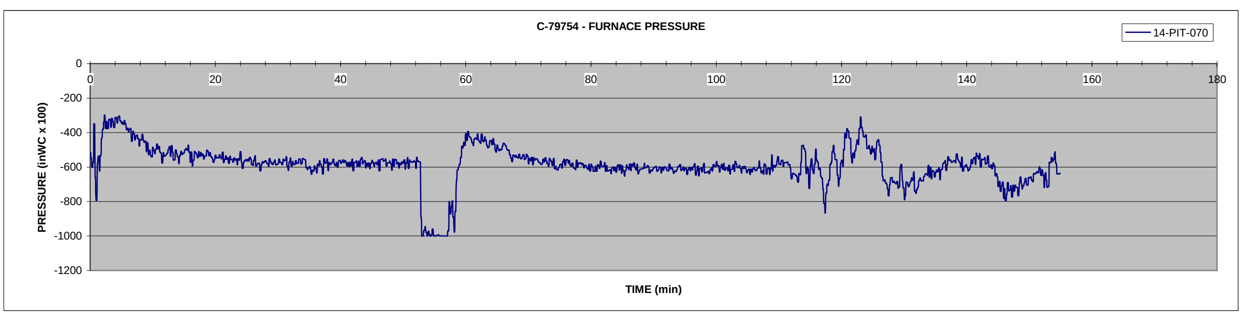
This appendix has 3 pages of data graphs for each of 20 Child TC Tests

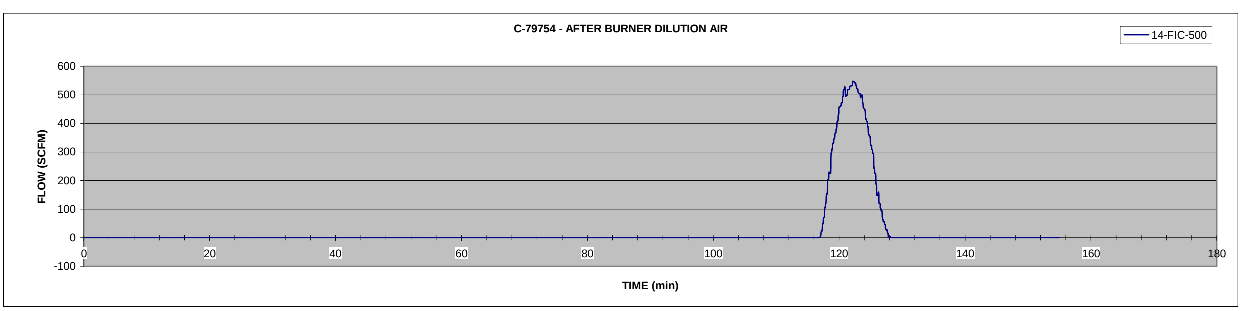
Appendix F – Child TC MPF Test # 1 (page 1 of 3)



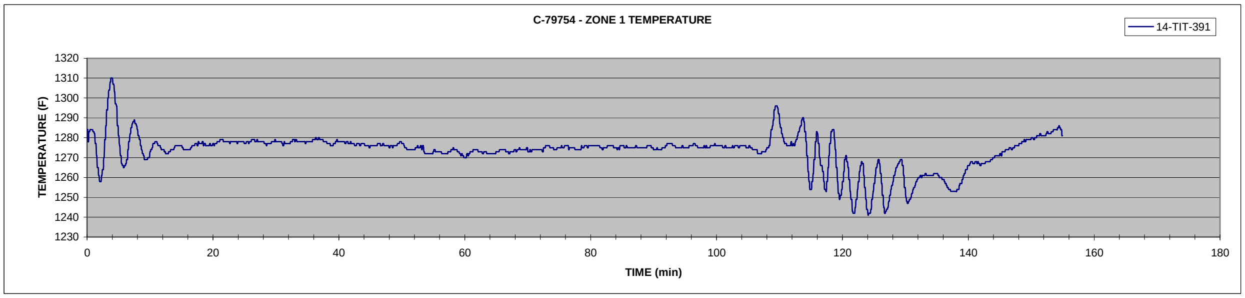


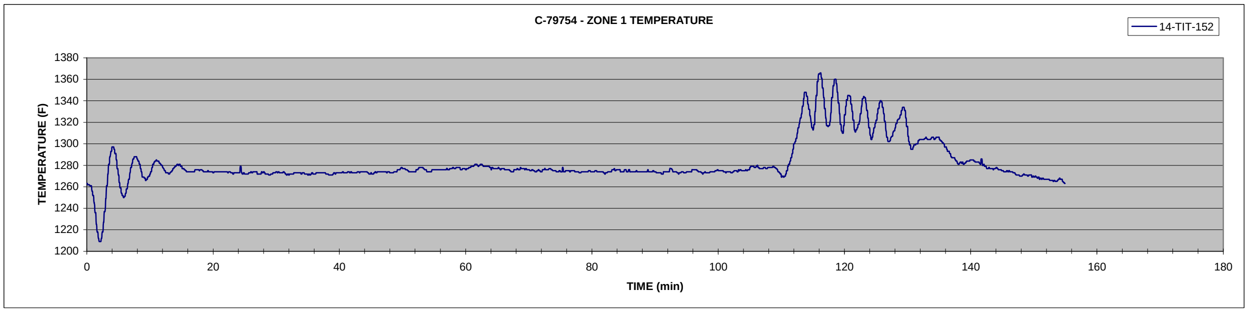


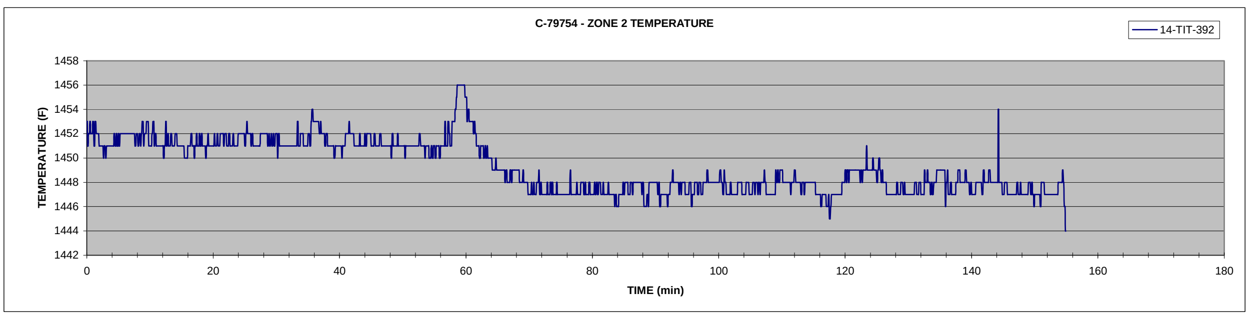


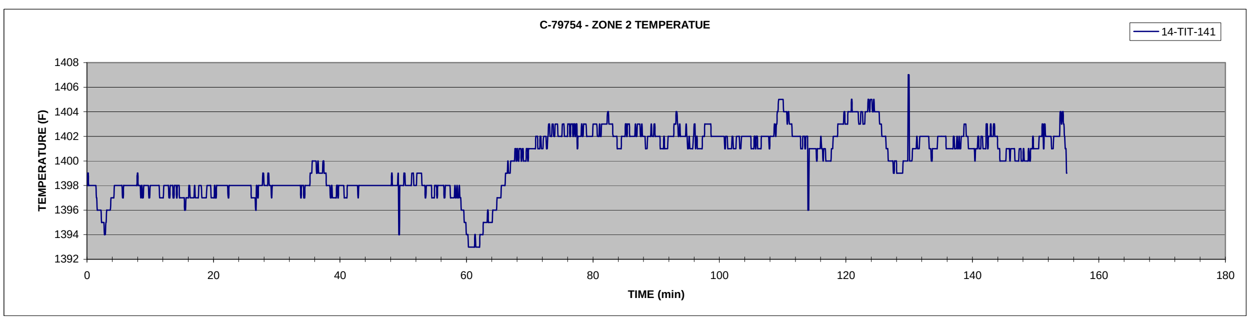


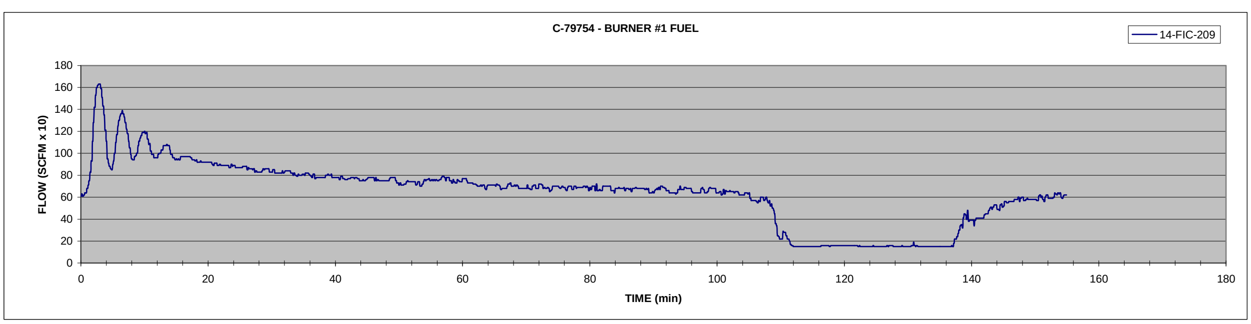
Appendix F – Child TC MPF Test # 1 (page 2 of 3)

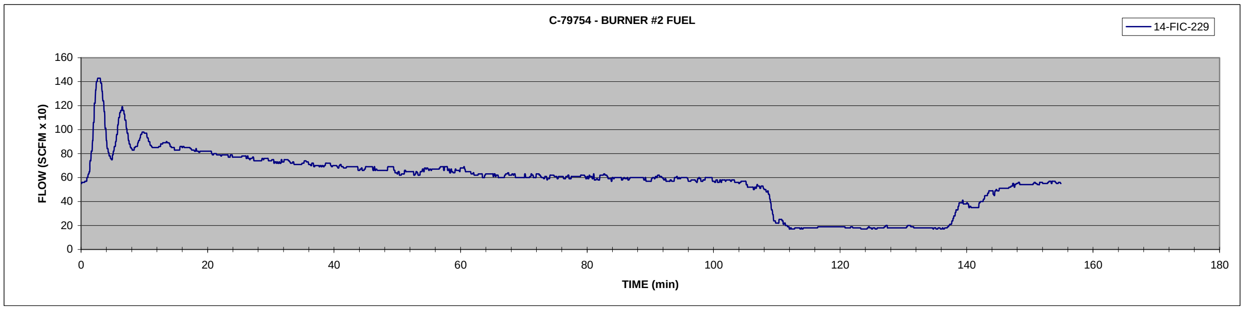


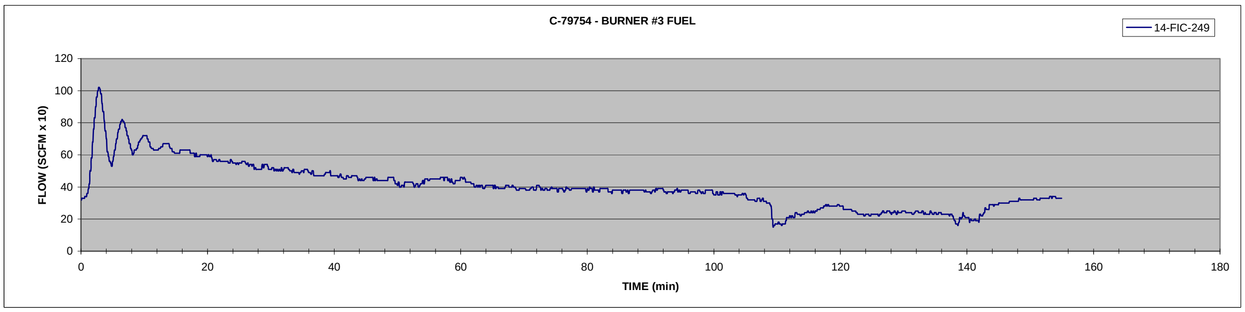


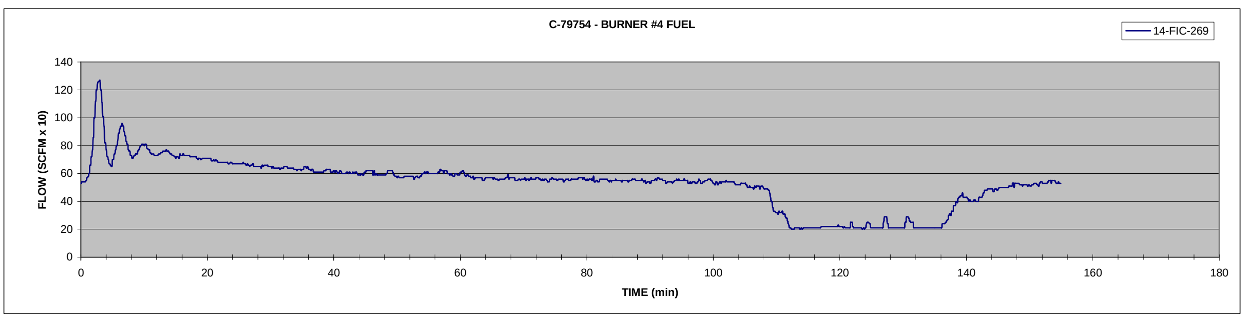


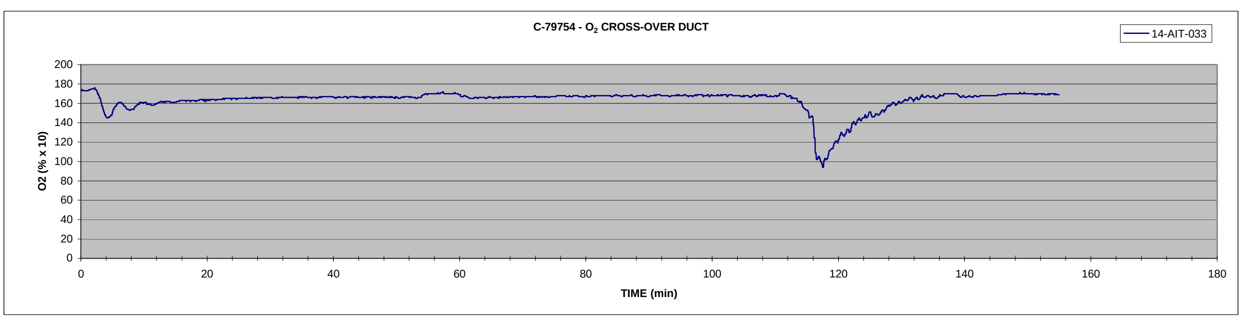


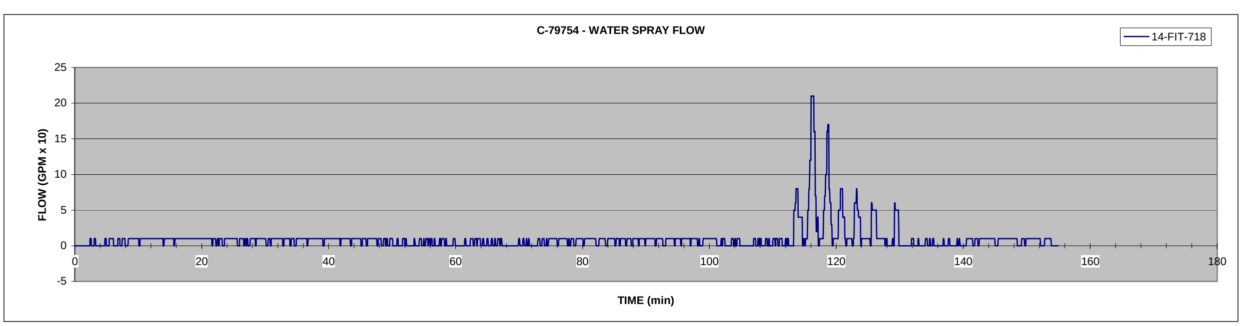



C-79754 - BURNER #2 FUEL
14-FIC-229
FLOW (SCFM x 10)
TIME (min)

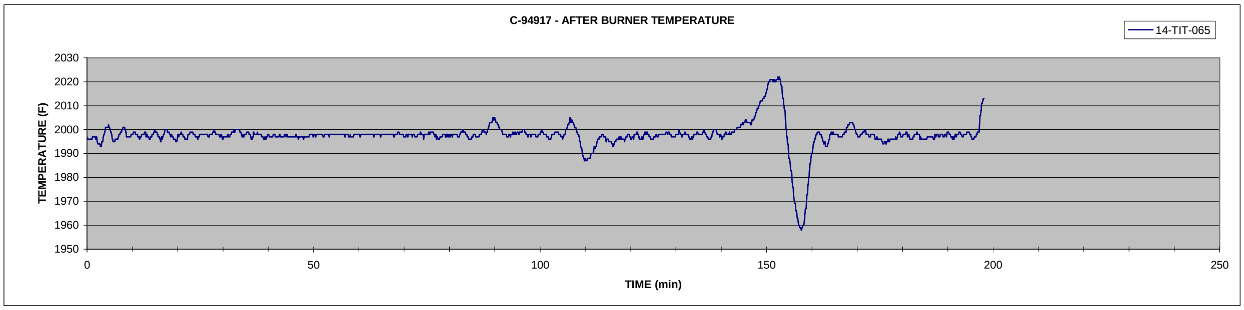

C-79754 - BURNER #3 FUEL
14-FIC-249
FLOW (SCFM x 10)
TIME (min)

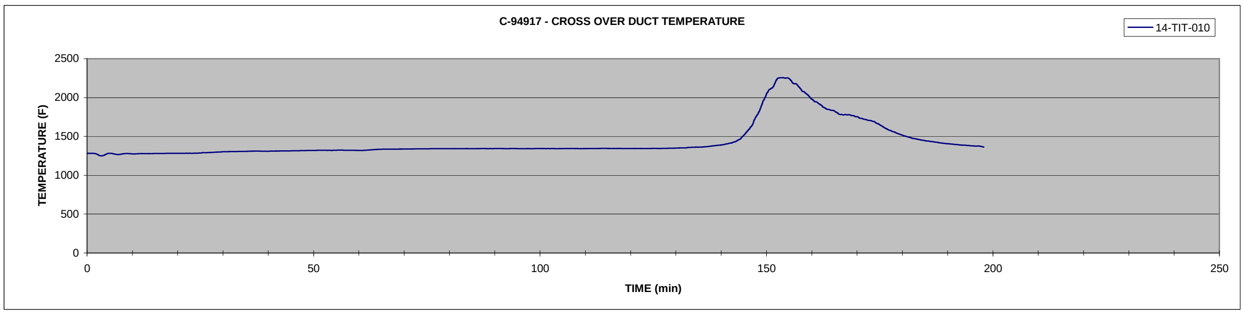

C-79754 - BURNER #4 FUEL
14-FIC-269
FLOW (SCFM x 10)
TIME (min)

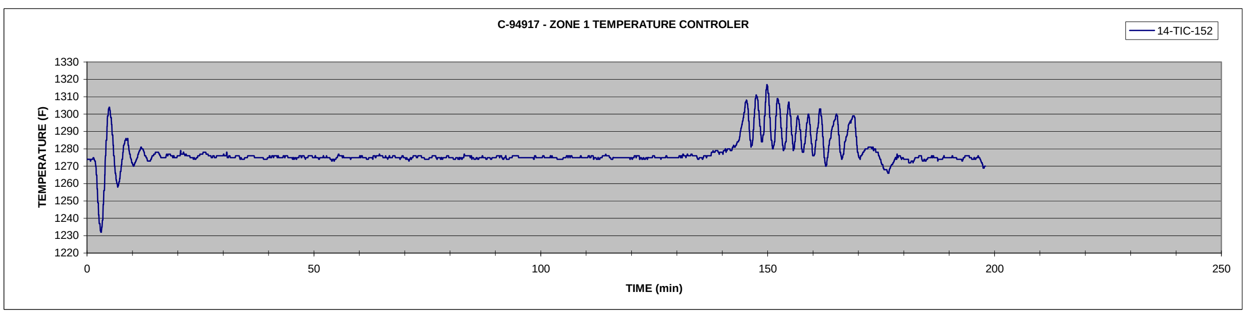

C-79754 - O2 CROSS-OVER DUCT
14-AIT-033
O2 (% x 10)
TIME (min)

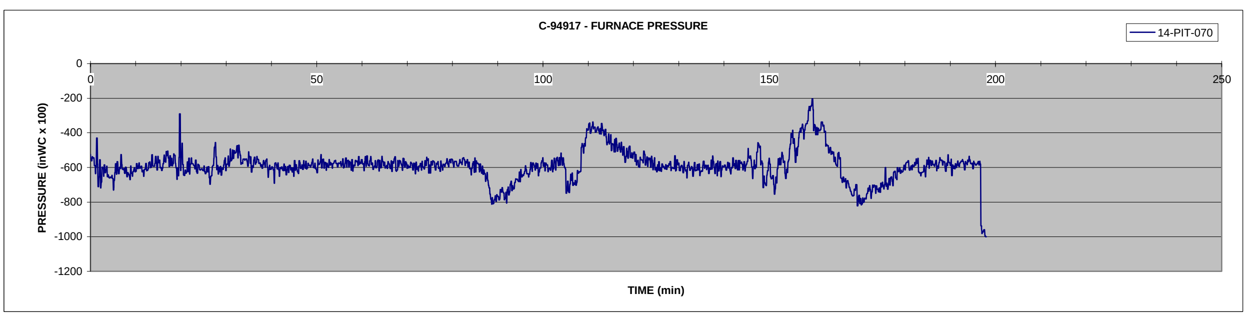

C-79754 - WATER SPRAY FLOW
14-FIT-718
FLOW (GPM x 10)
TIME (min)

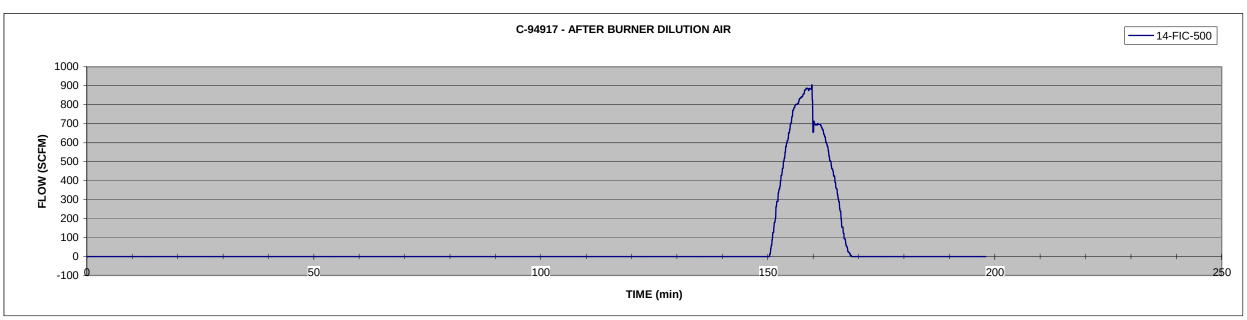
Appendix F – Child TC MPF Test # 2 (page 1 of 3)



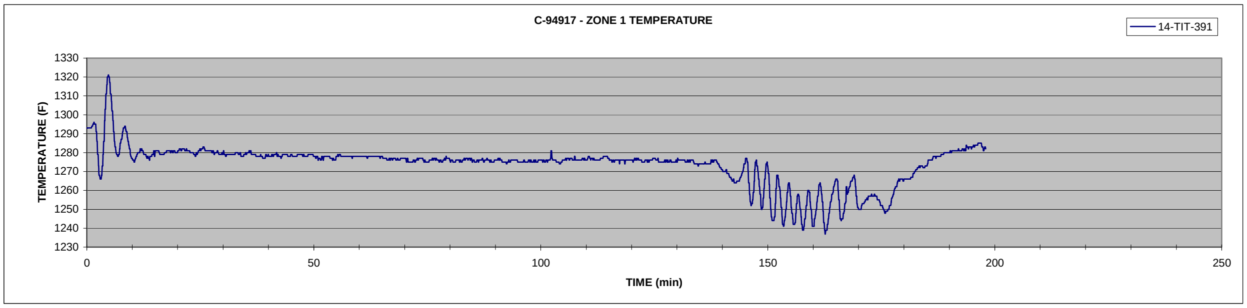


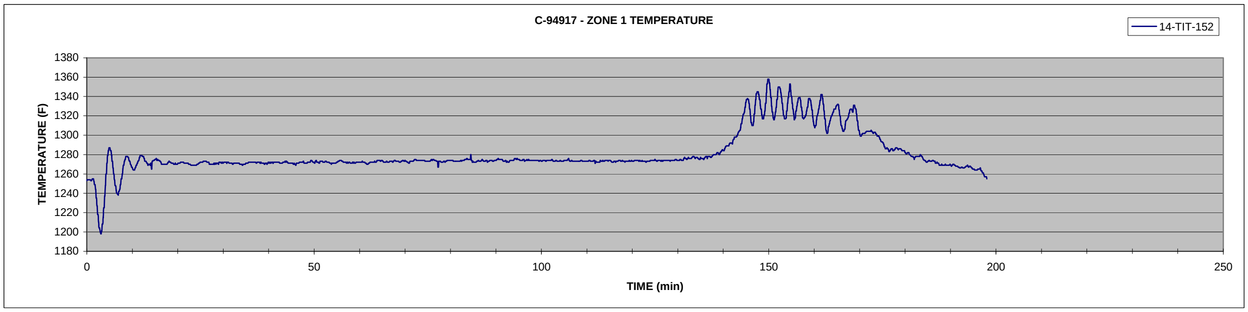


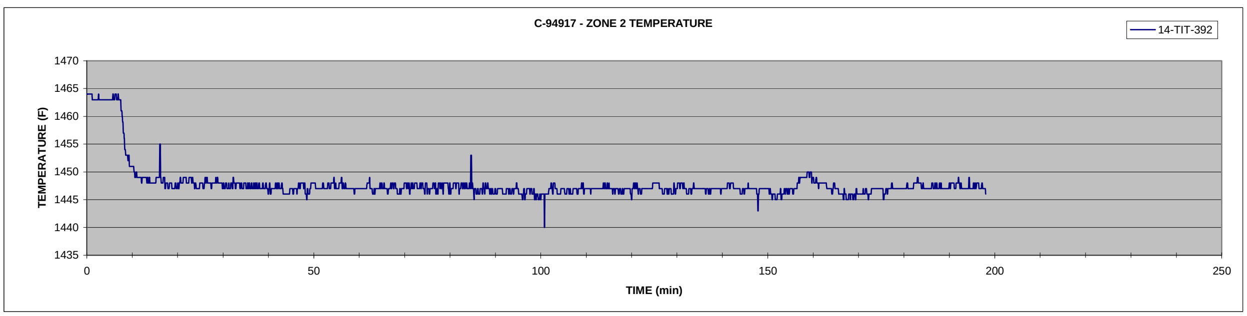


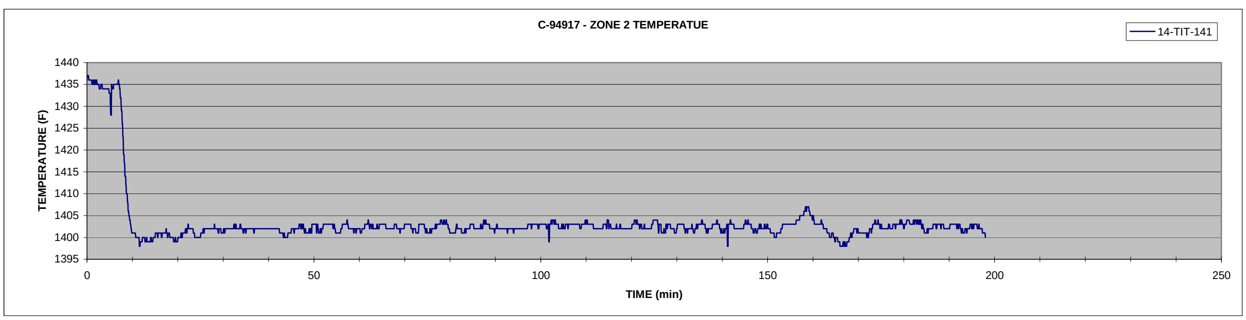


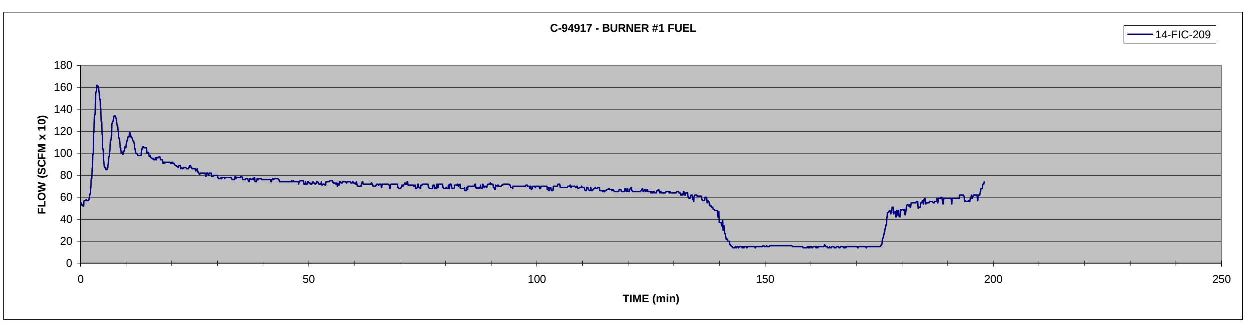
Appendix F – Child TC MPF Test # 2 (page 2 of 3)

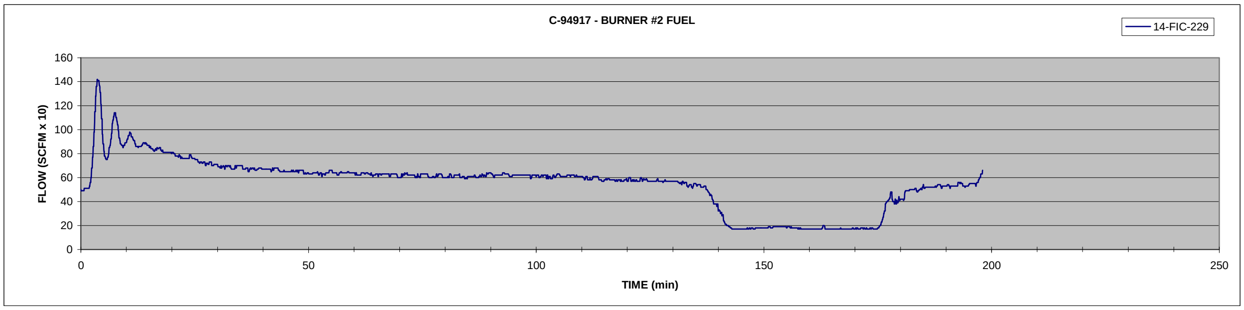


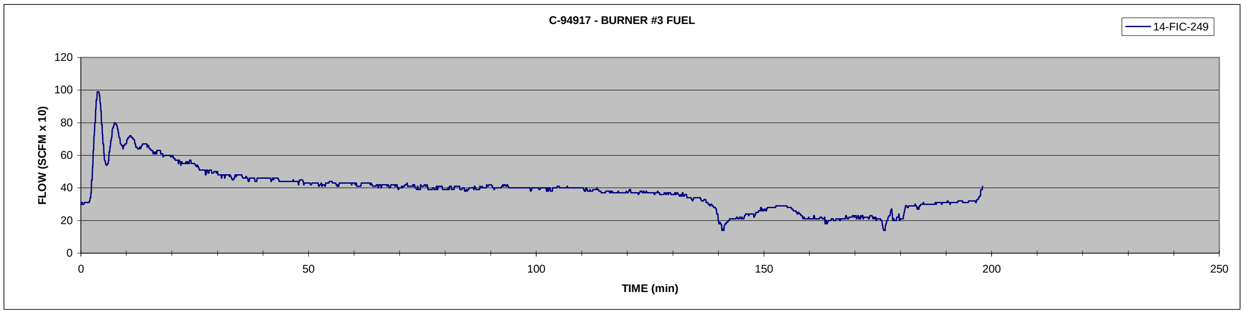


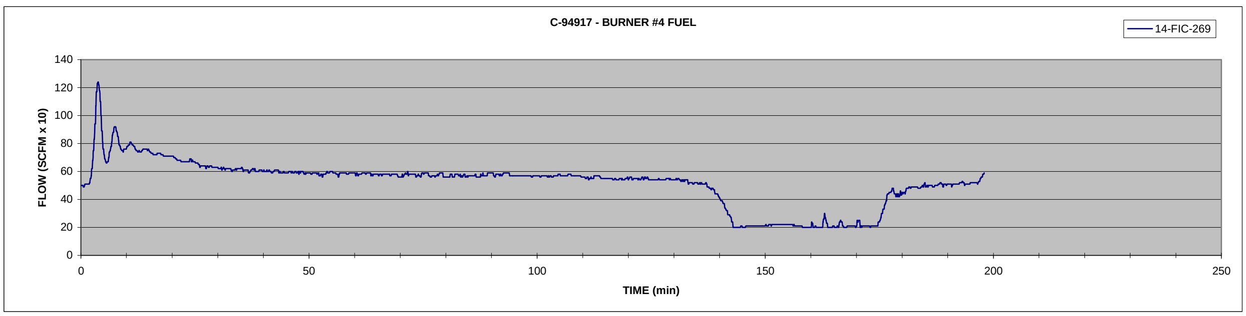


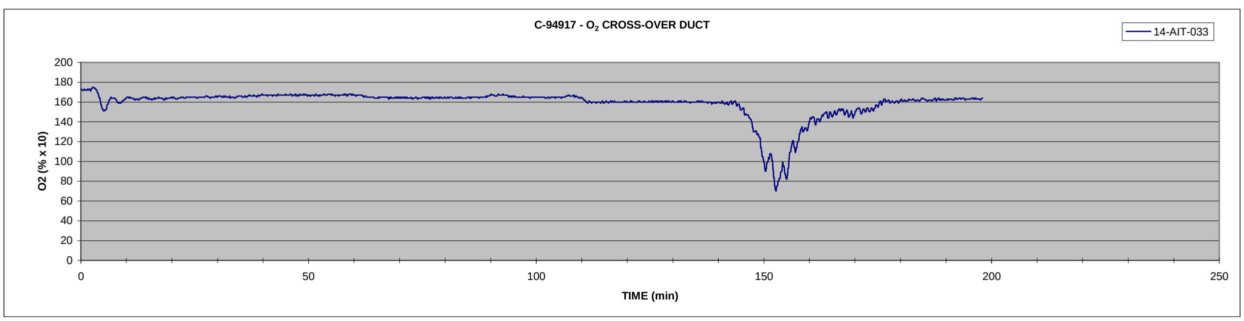


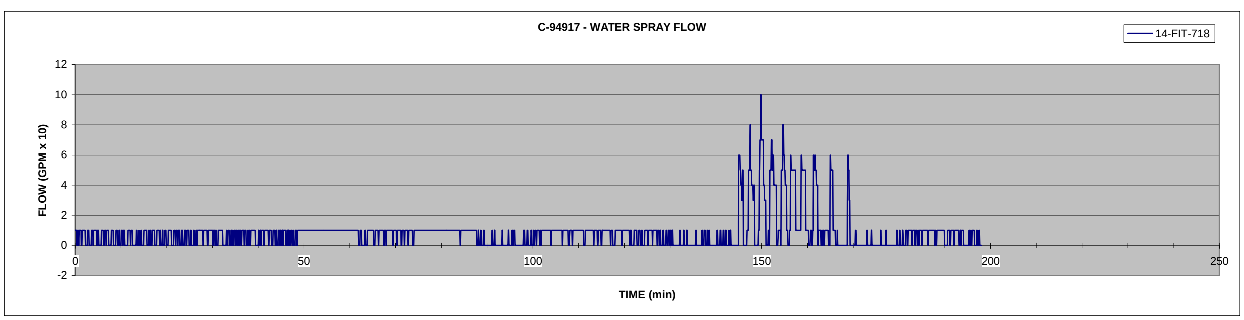



C-94917 - BURNER #2 FUEL
14-FIC-229
FLOW (SCFM x 10)
TIME (min)
0
20
40
60
80
100
120
140
160
0
50
100
150
200
250

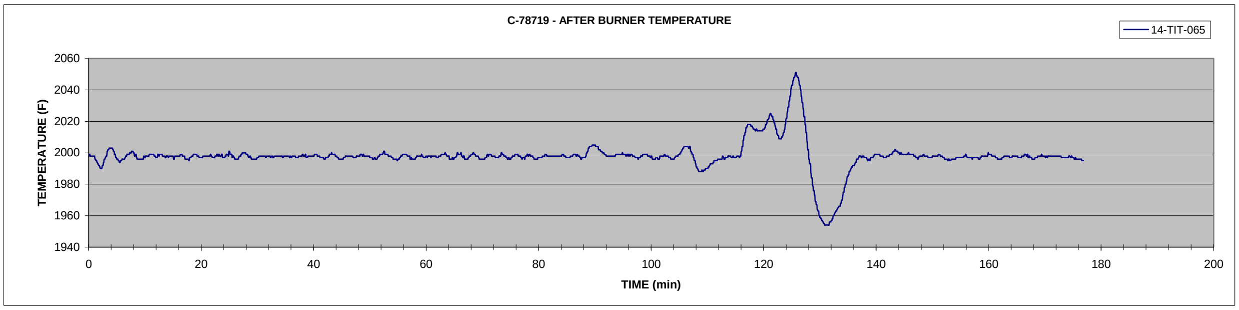

C-94917 - BURNER #3 FUEL
14-FIC-249
FLOW (SCFM x 10)
TIME (min)
0
20
40
60
80
100
120
0
50
100
150
200
250

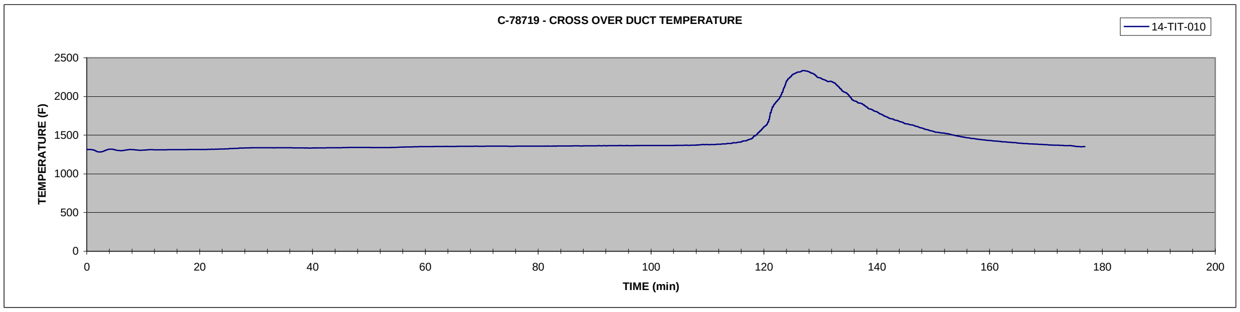

C-94917 - BURNER #4 FUEL
14-FIC-269
FLOW (SCFM x 10)
TIME (min)
0
20
40
60
80
100
120
140
0
50
100
150
200
250

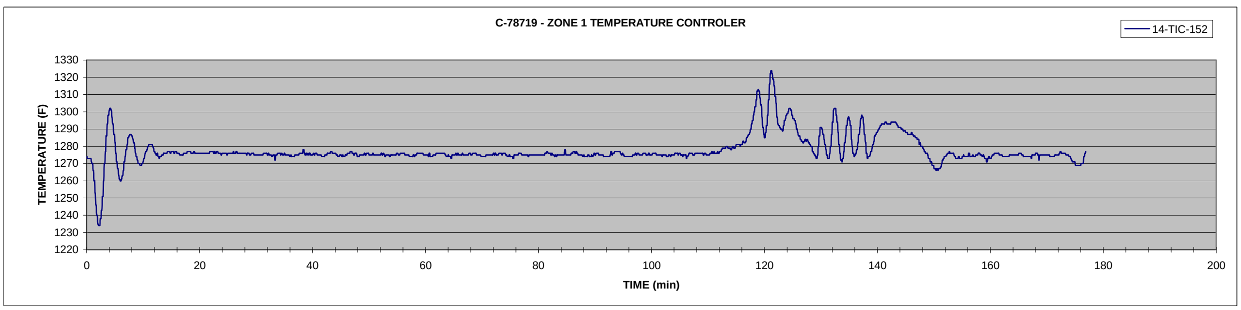

C-94917 - O_2 CROSS-OVER DUCT
14-AIT-033
O2 (% x 10)
TIME (min)
0
20
40
60
80
100
120
140
160
180
200
0
50
100
150
200
250

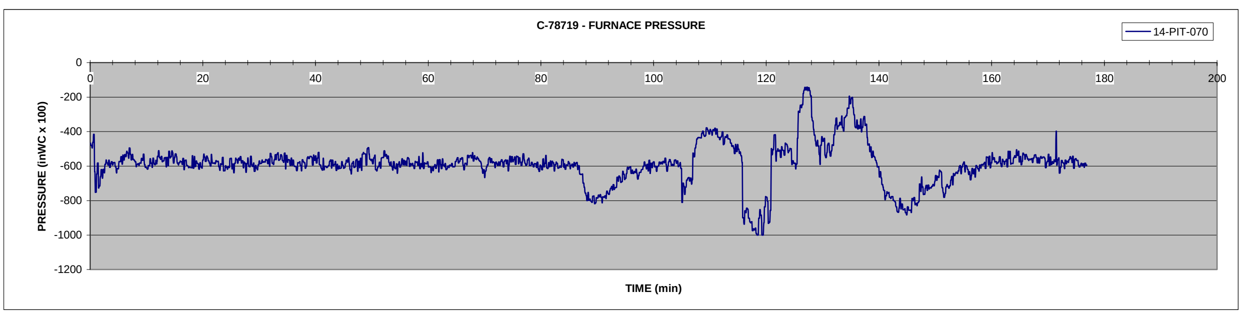

C-94917 - WATER SPRAY FLOW
14-FIT-718
FLOW (GPM x 10)
TIME (min)
-2
0
2
4
6
8
10
12
0
50
100
150
200
250

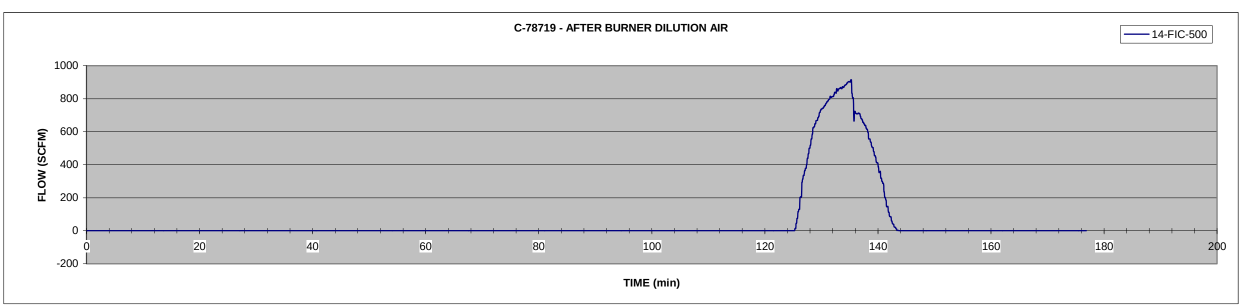
Appendix F – Child TC MPF Test # 3 (page 1 of 3)



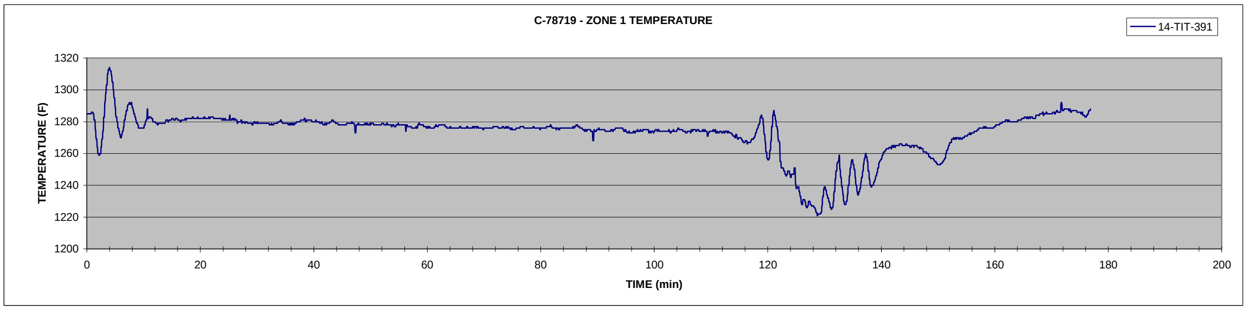


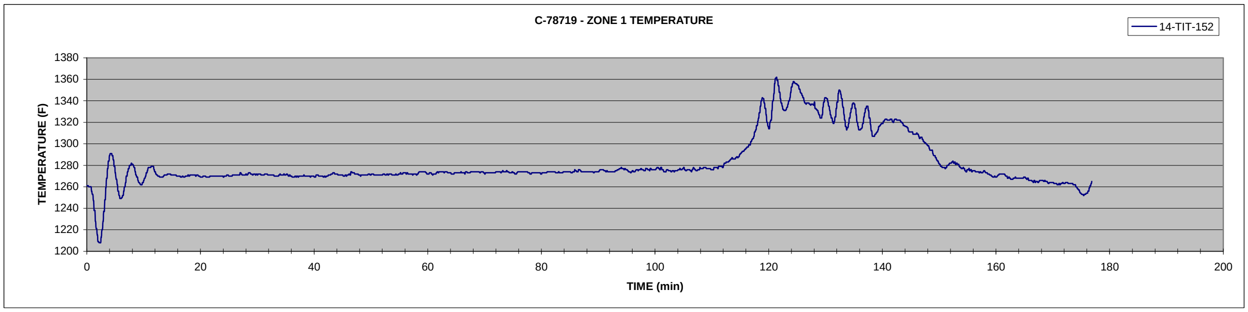


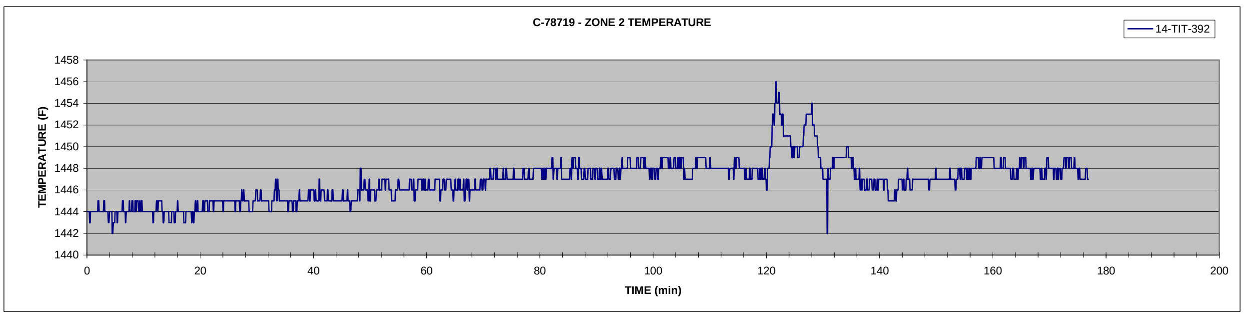


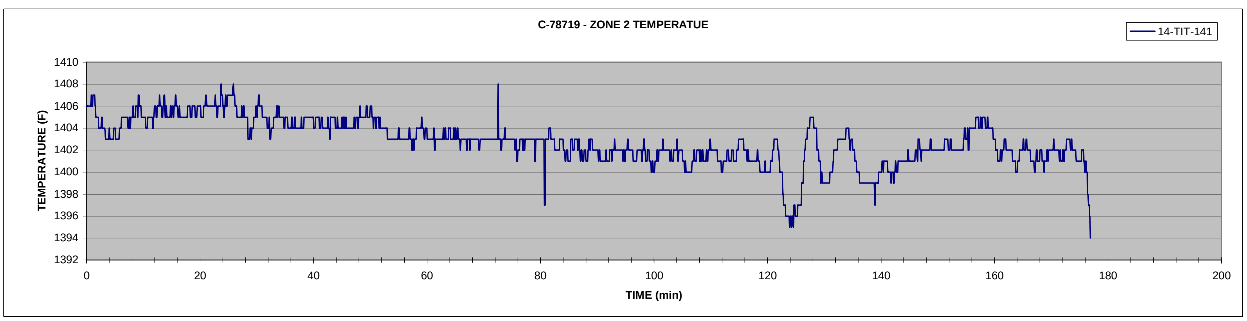


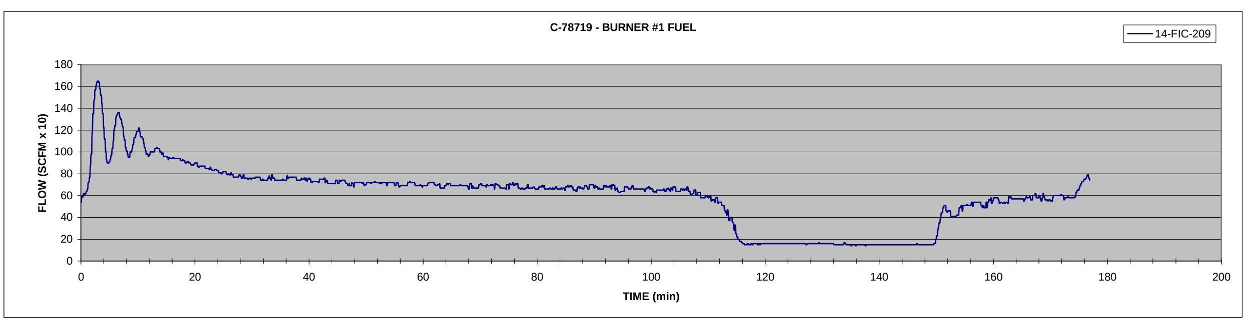
Appendix F – Child TC MPF Test # 3 (page 2 of 3)



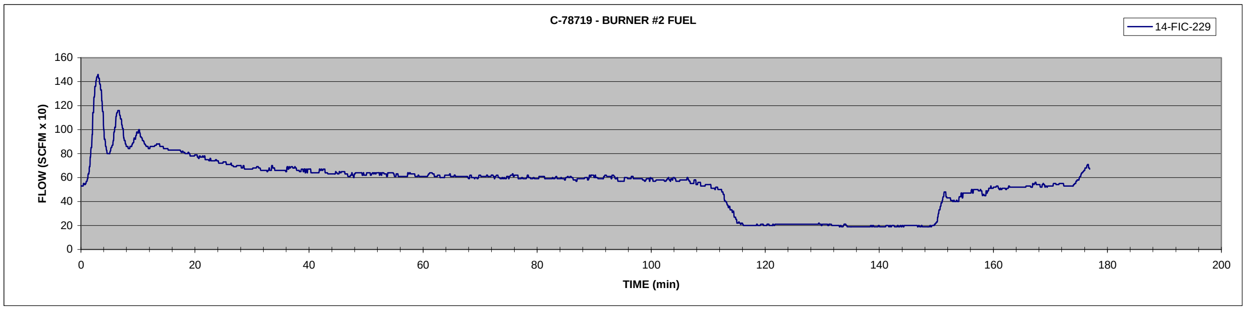


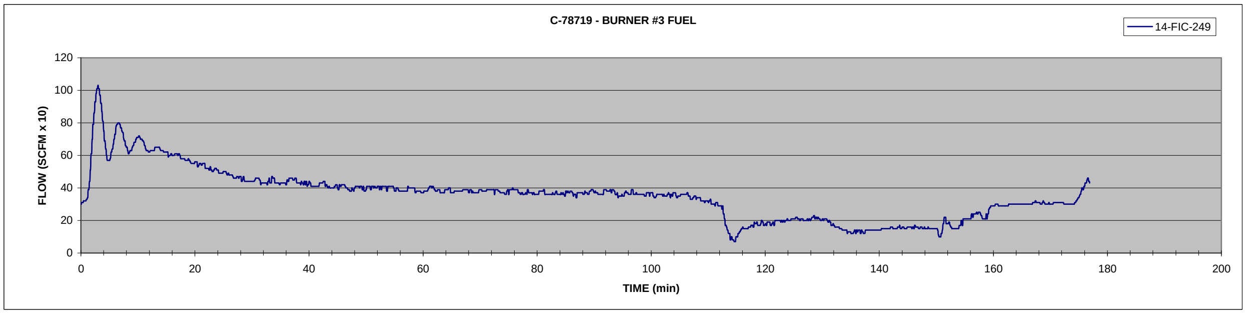


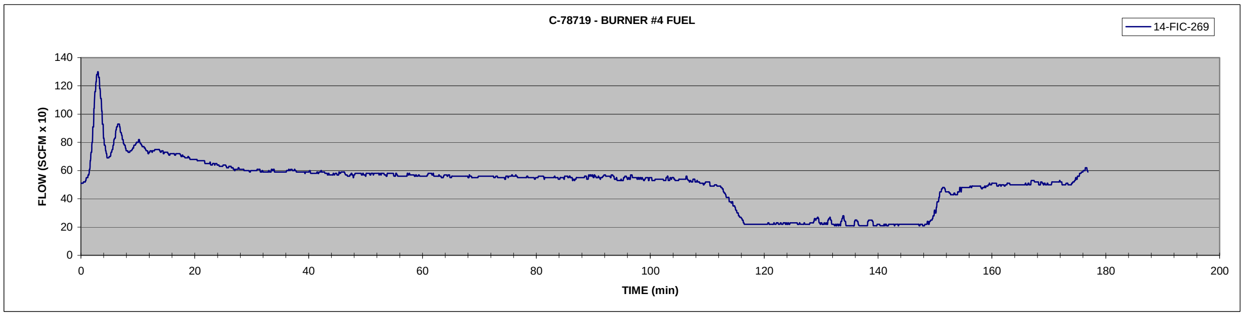


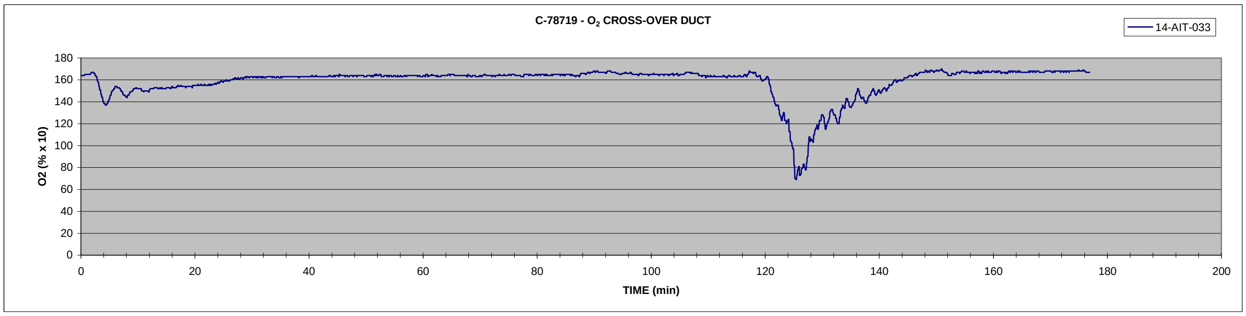


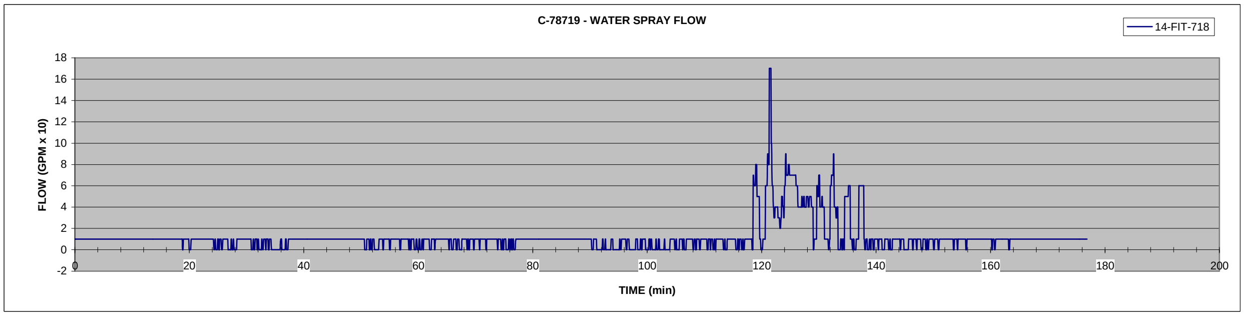
Appendix F – Child TC MPF Test # 3 (page 3 of 3)



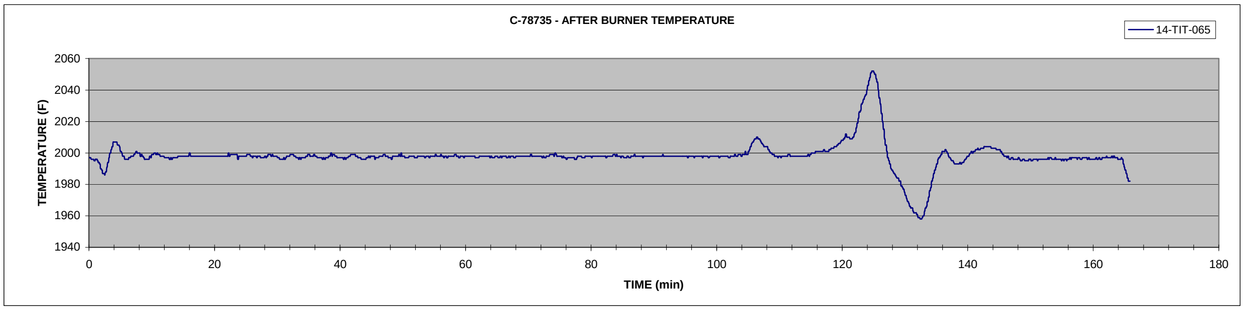


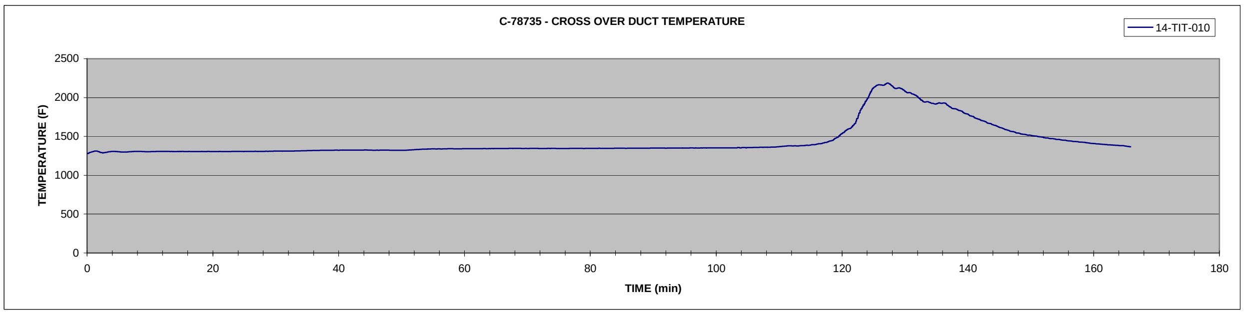


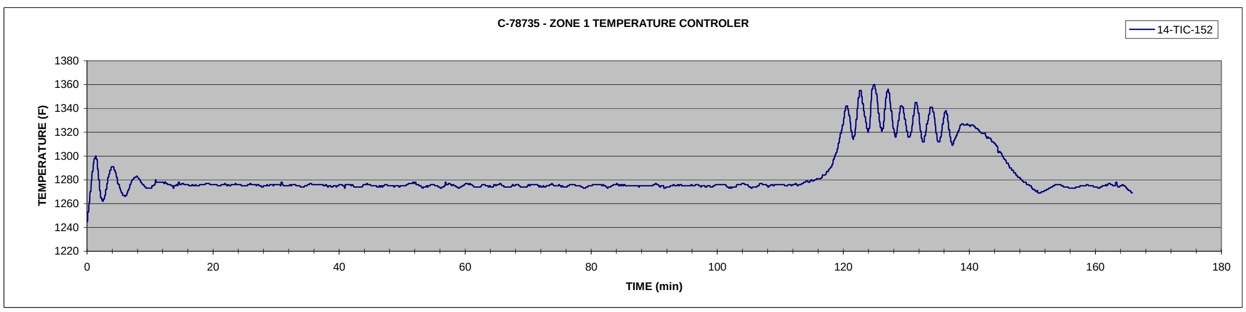


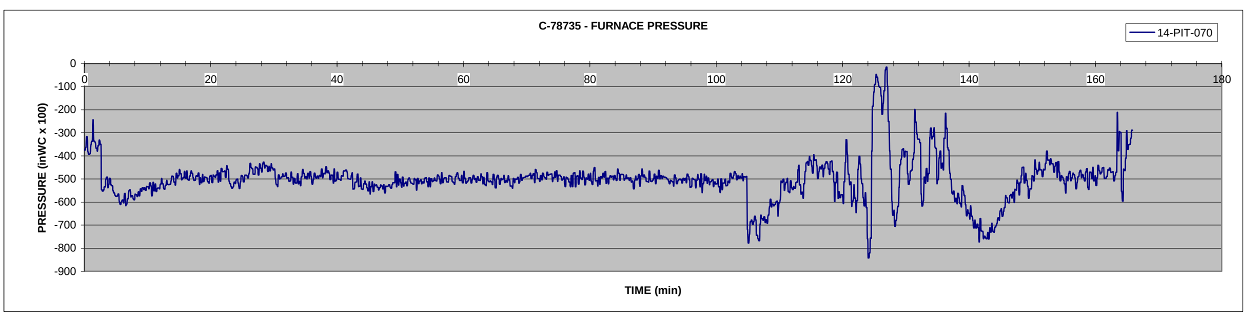


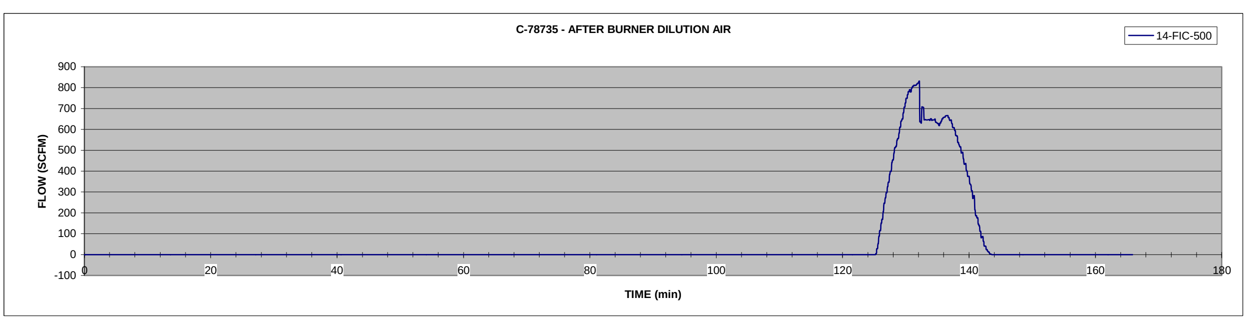
Appendix F – Child TC MPF Test # 4 (page 1 of 3)

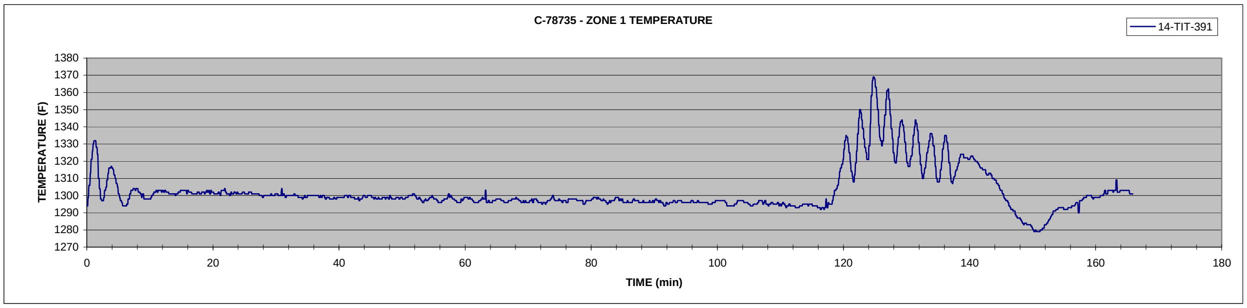




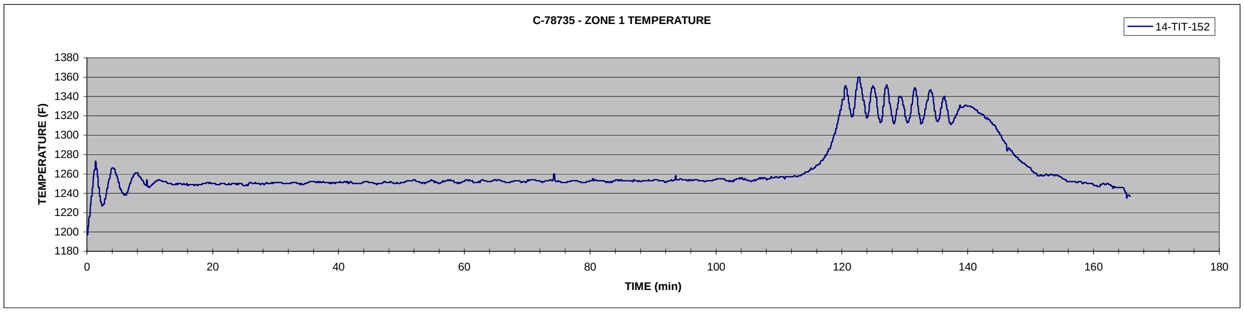




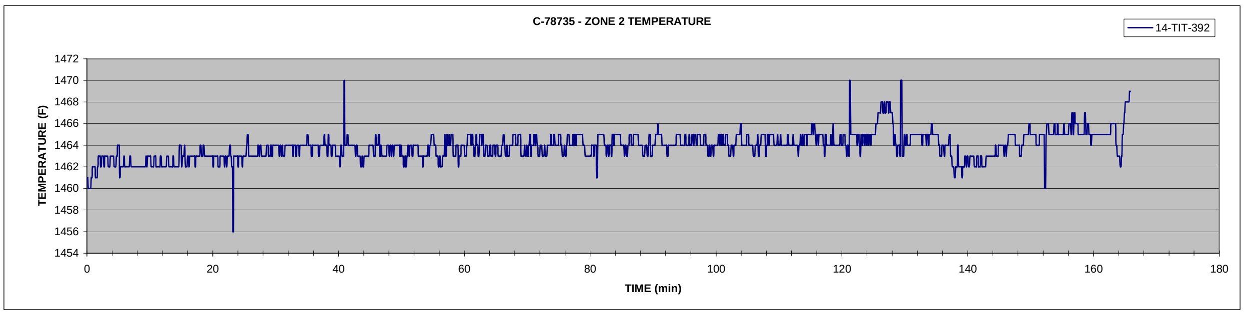




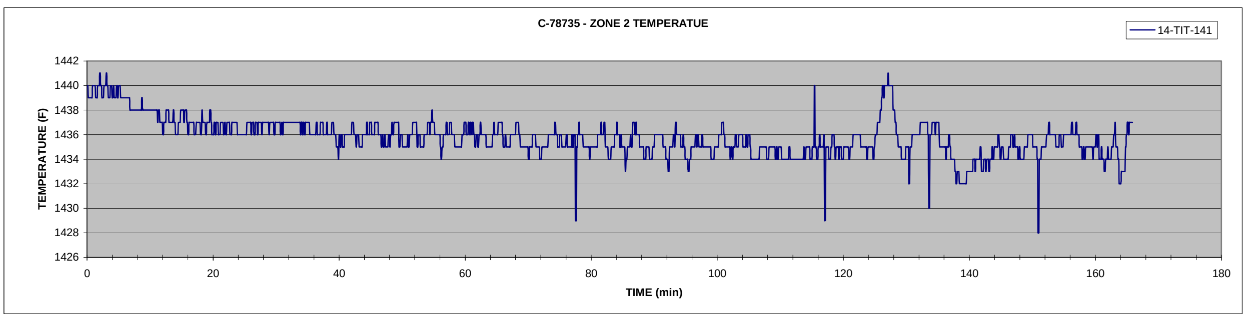
C-78735 - ZONE 1 TEMPERATURE
14-TIT-391
TEMPERATURE (F)
TIME (min)



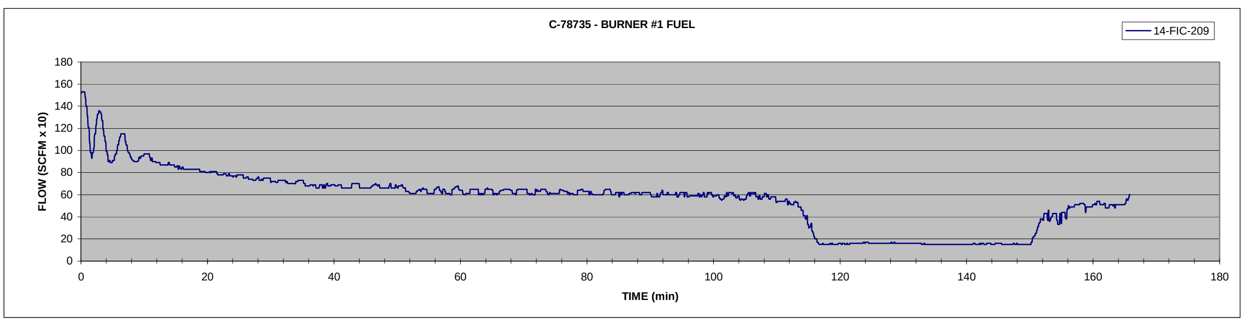
C-78735 - ZONE 1 TEMPERATURE
14-TIT-152
TEMPERATURE (F)
TIME (min)



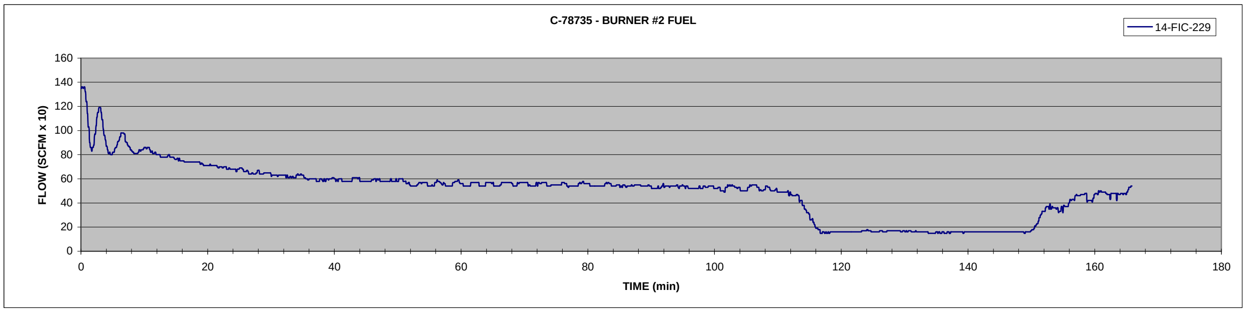
C-78735 - ZONE 2 TEMPERATURE
14-TIT-392
TEMPERATURE (F)
TIME (min)

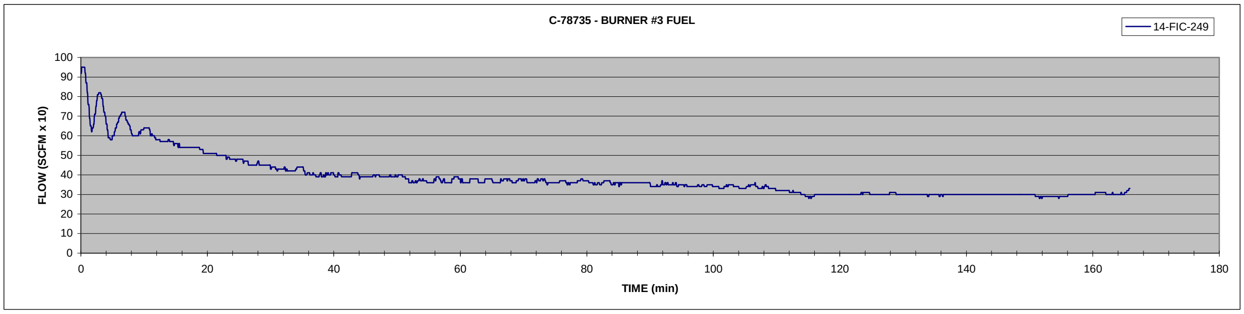


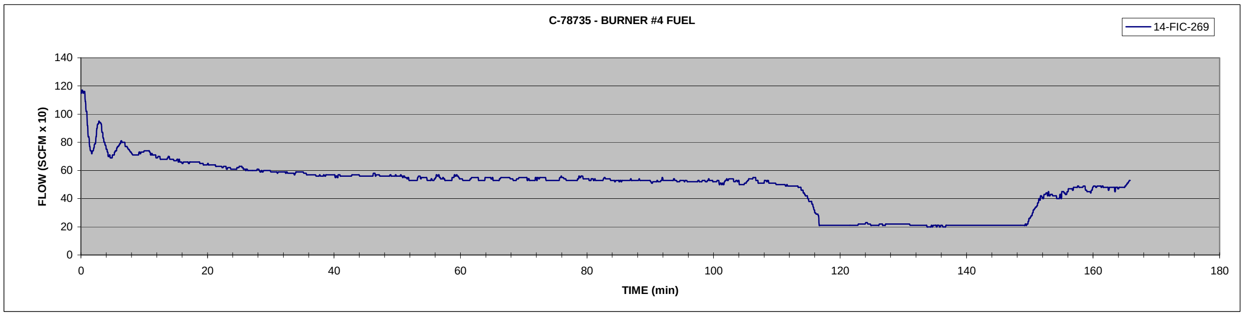
C-78735 - ZONE 2 TEMPERATUE
14-TIT-141
TEMPERATURE (F)
TIME (min)

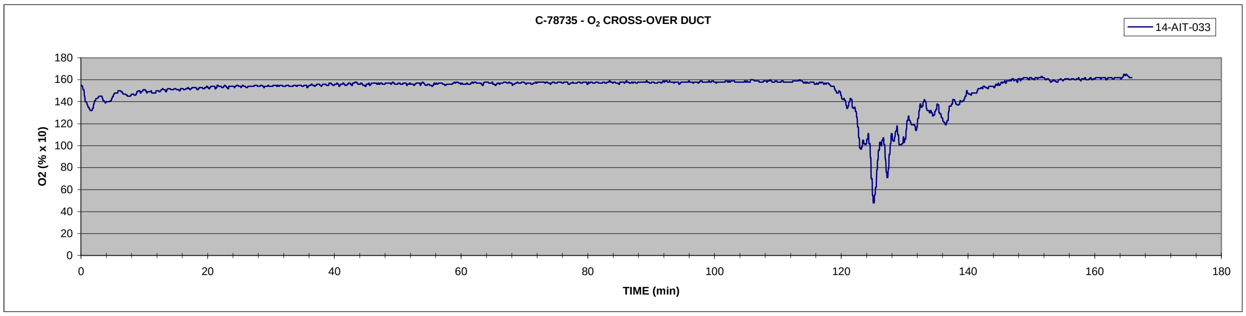


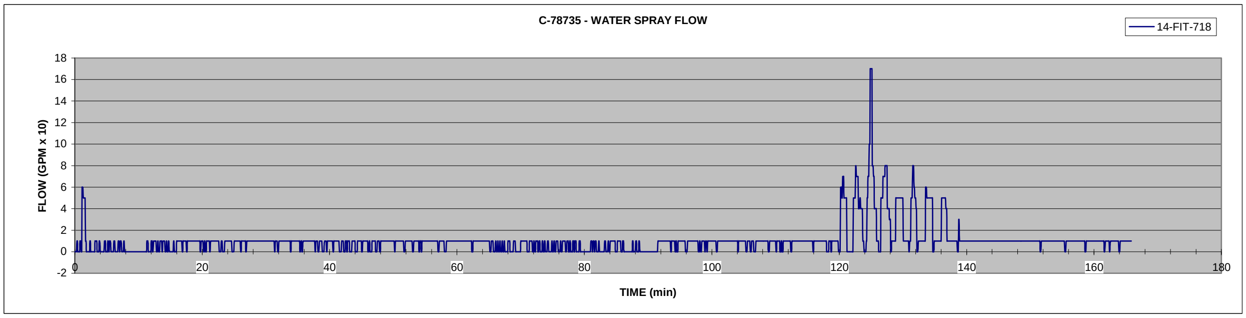
C-78735 - BURNER #1 FUEL
14-FIC-209
FLOW (SCFM x 10)
TIME (min)


C-78735 - BURNER #2 FUEL
14-FIC-229
FLOW (SCFM x 10)
TIME (min)

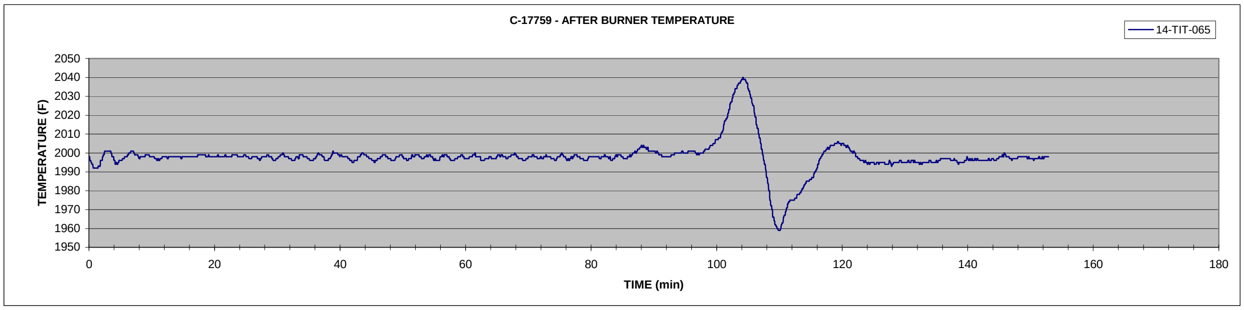

C-78735 - BURNER #3 FUEL
14-FIC-249
FLOW (SCFM x 10)
TIME (min)

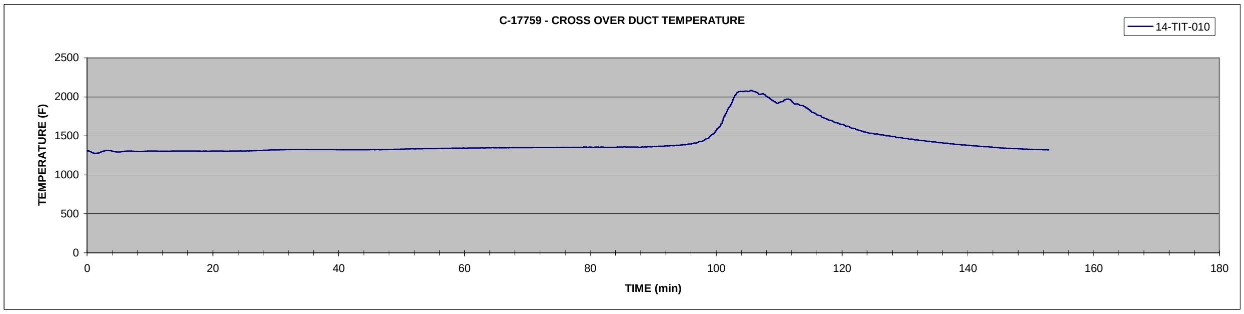

C-78735 - BURNER #4 FUEL
14-FIC-269
FLOW (SCFM x 10)
TIME (min)

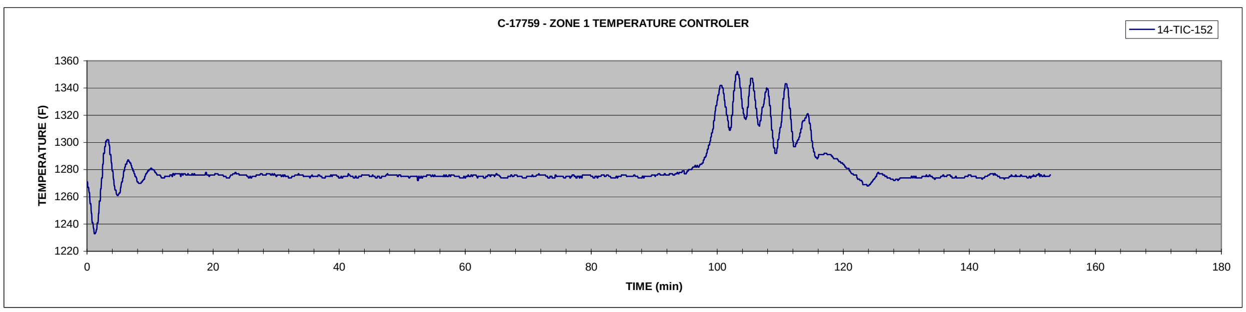

C-78735 - O_2 CROSS-OVER DUCT
14-AIT-033
O2 (% x 10)
TIME (min)

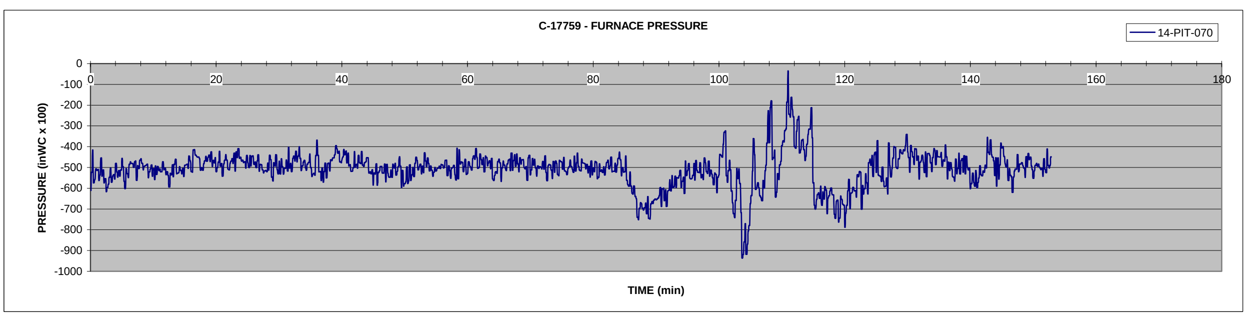

C-78735 - WATER SPRAY FLOW
14-FIT-718
FLOW (GPM x 10)
TIME (min)

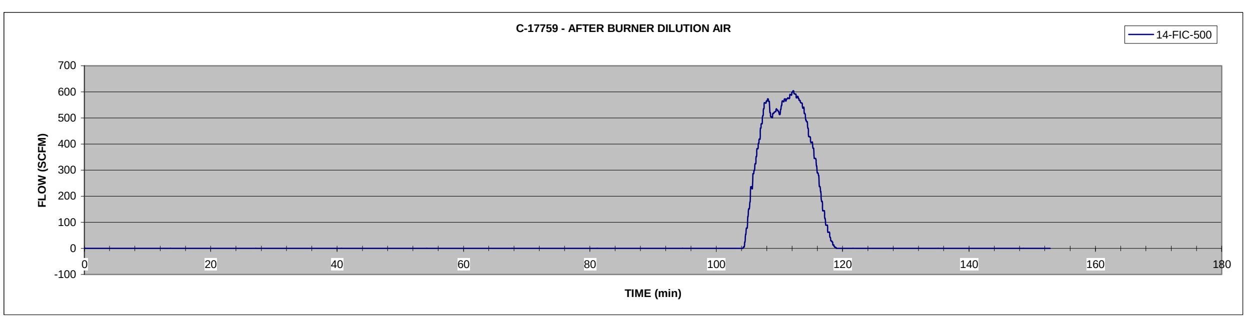
Appendix F – Child TC MPF Test # 5 (page 1 of 3)



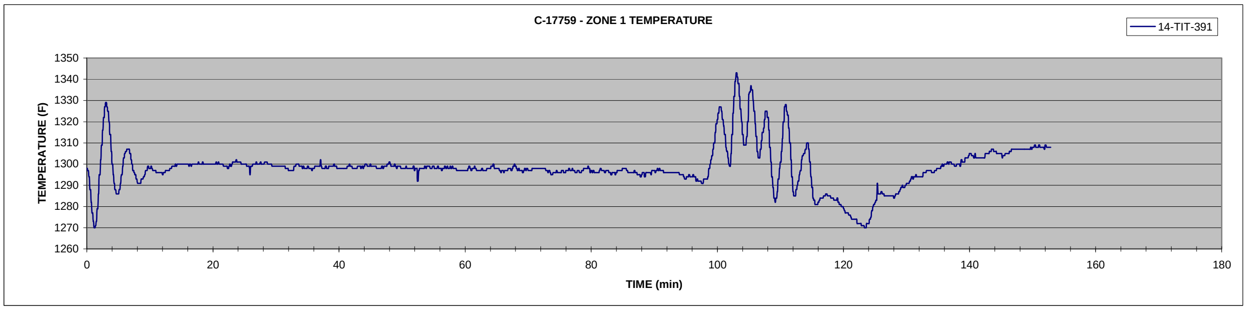


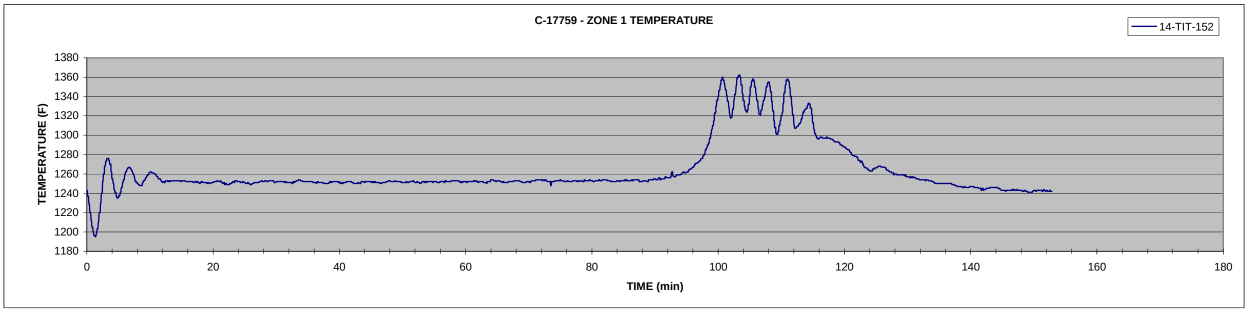


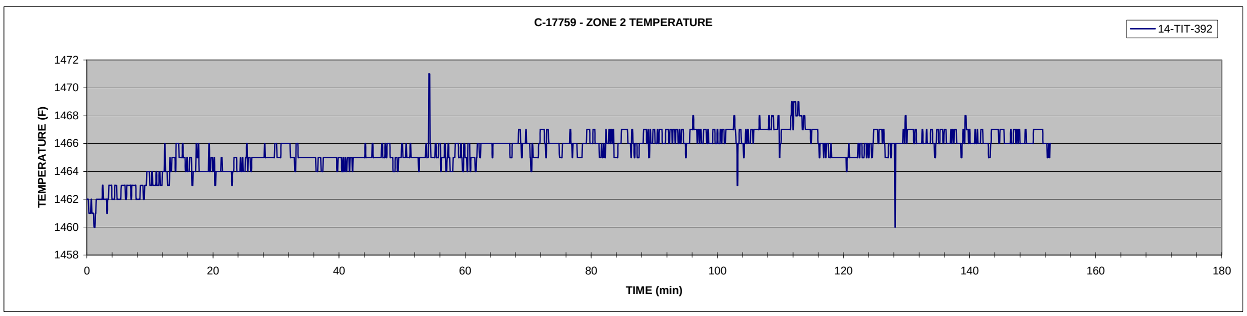


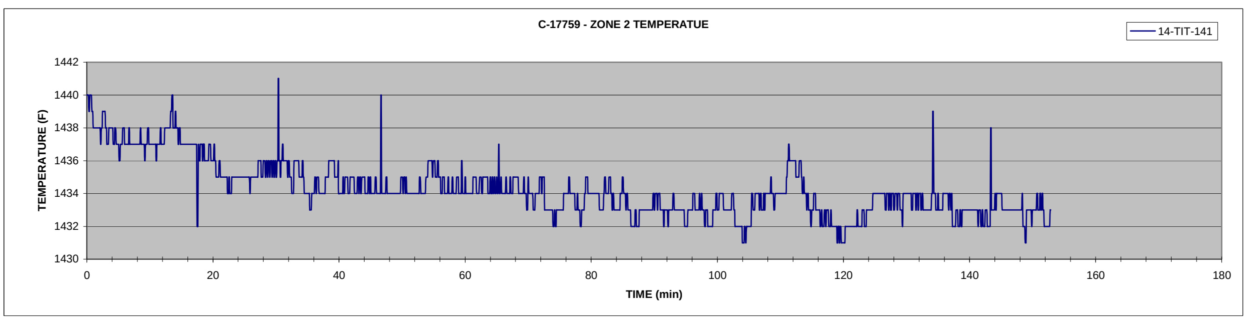


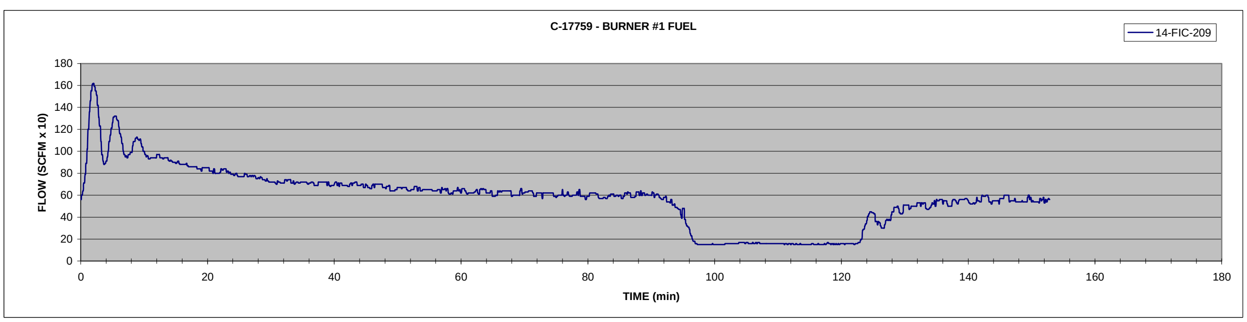
Appendix F – Child TC MPF Test # 5 (page 2 of 3)

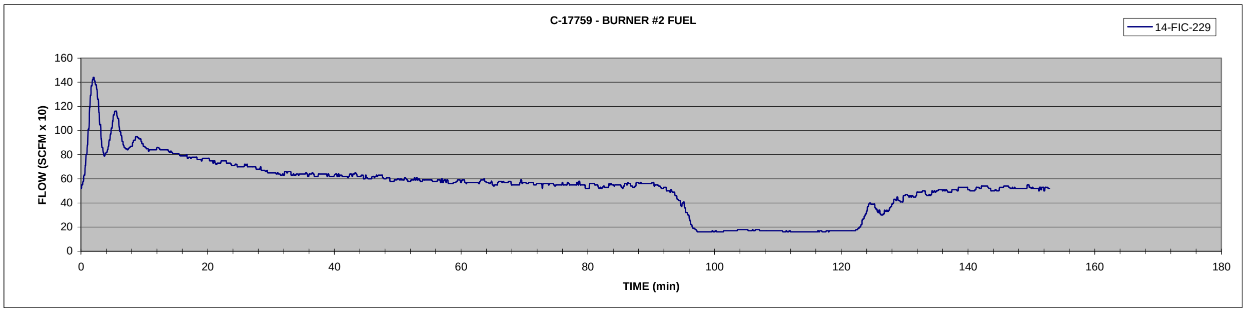


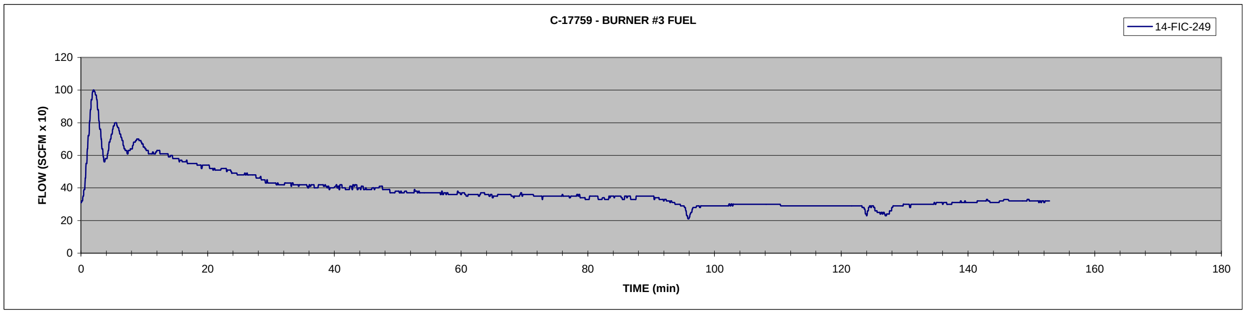


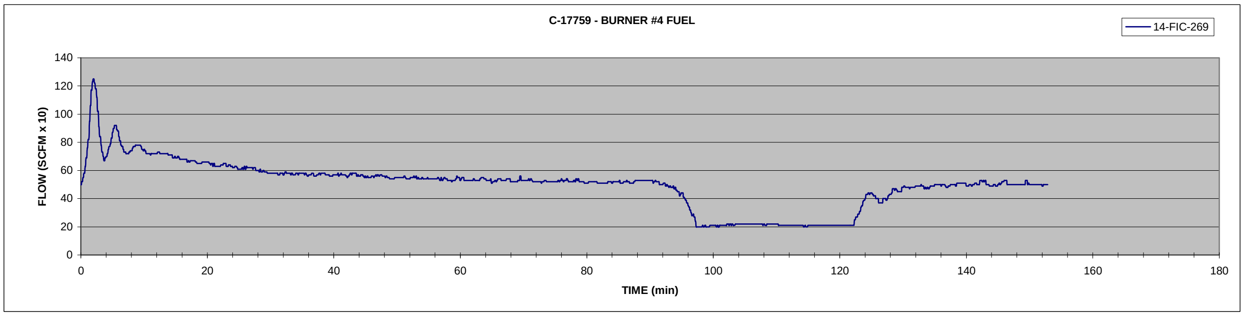


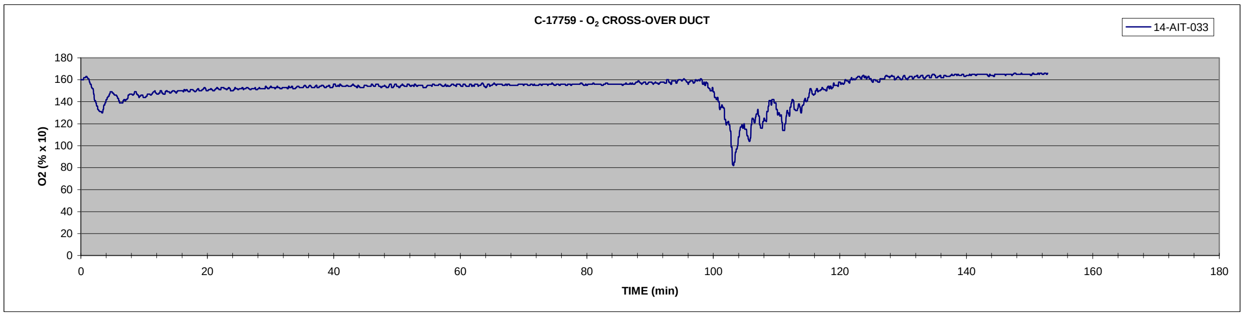


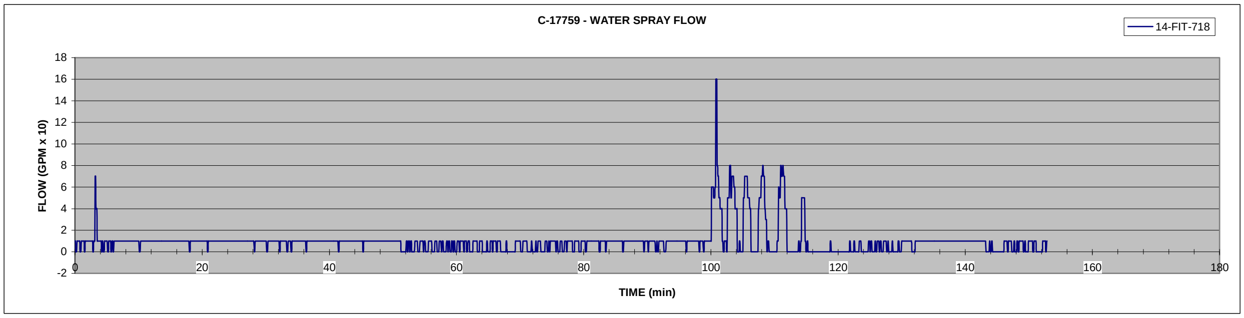



C-17759 - BURNER #2 FUEL
14-FIC-229
FLOW (SCFM x 10)
TIME (min)
0
20
40
60
80
100
120
140
160
180

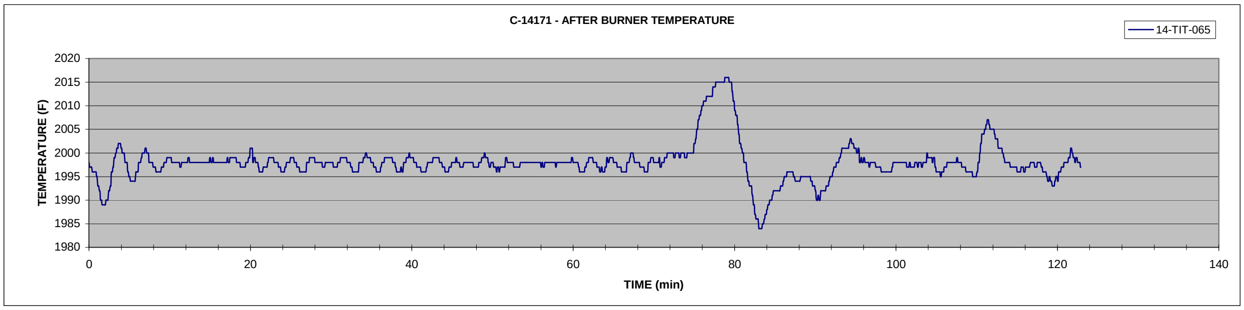

C-17759 - BURNER #3 FUEL
14-FIC-249
FLOW (SCFM x 10)
TIME (min)
0
20
40
60
80
100
120
140
160
180

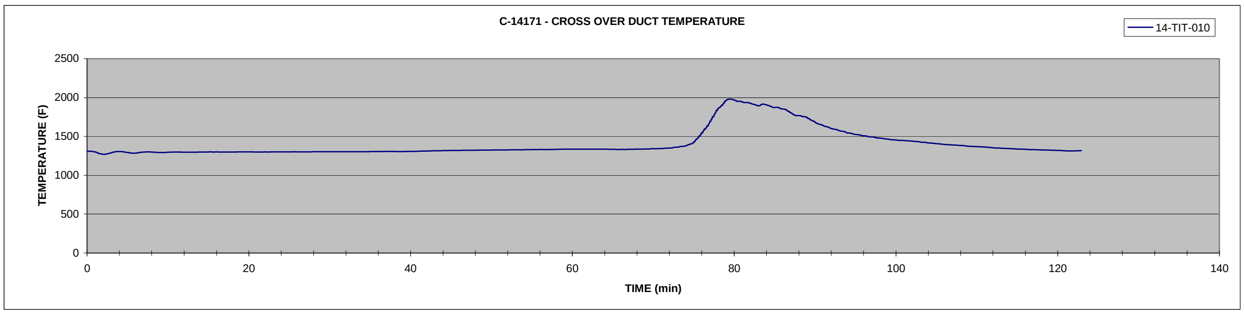

C-17759 - BURNER #4 FUEL
14-FIC-269
FLOW (SCFM x 10)
TIME (min)
0
20
40
60
80
100
120
140
160
180

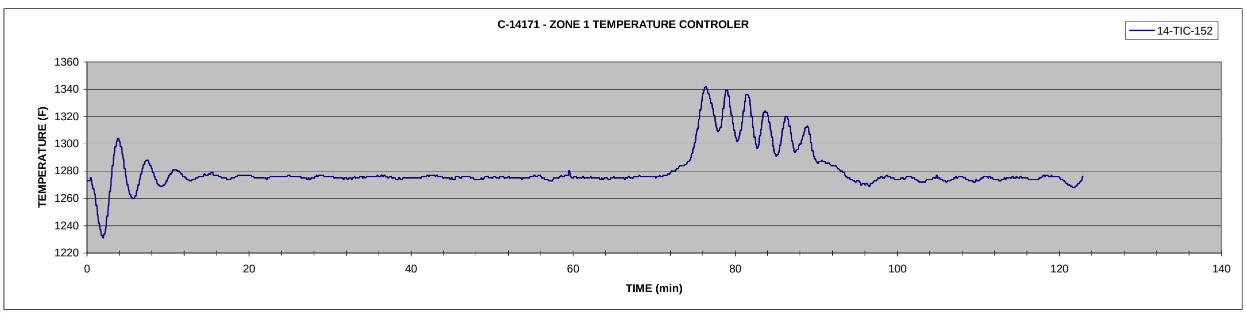

C-17759 - O2 CROSS-OVER DUCT
14-AIT-033
O2 (% x 10)
TIME (min)
0
20
40
60
80
100
120
140
160
180

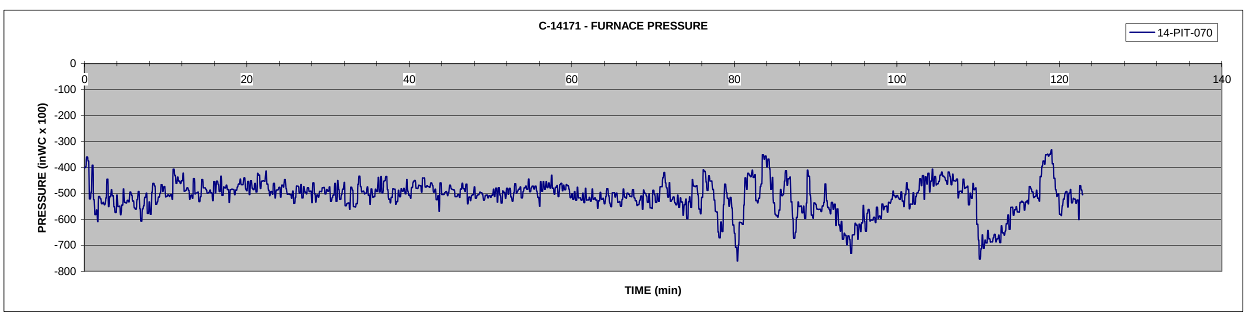

C-17759 - WATER SPRAY FLOW
14-FIT-718
FLOW (GPM x 10)
TIME (min)
-2
0
2
4
6
8
10
12
14
16
18
20
40
60
80
100
120
140
160
180

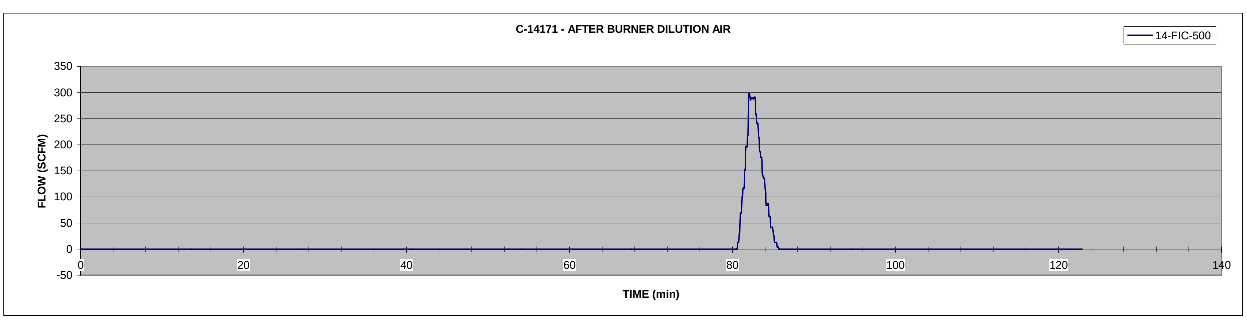
Appendix F – Child TC MPF Test # 6 (page 1 of 3)



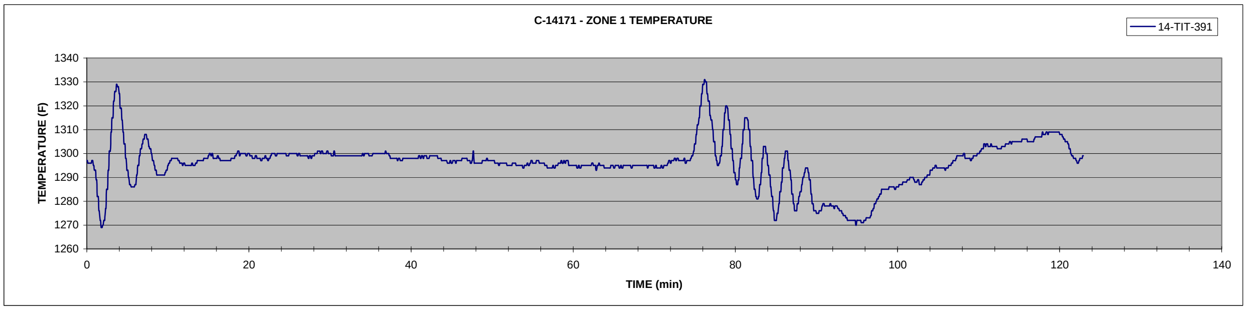


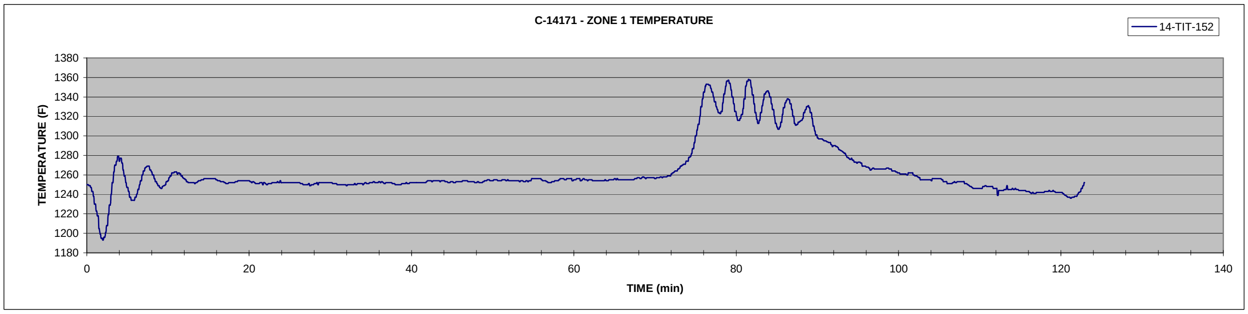


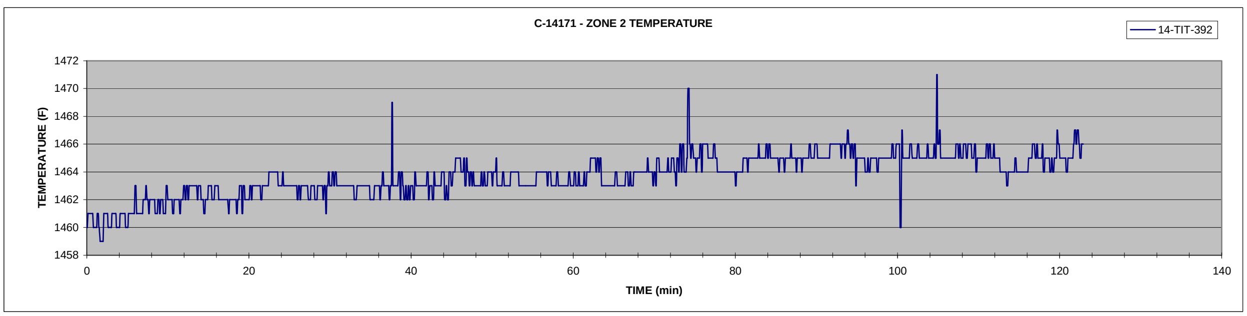


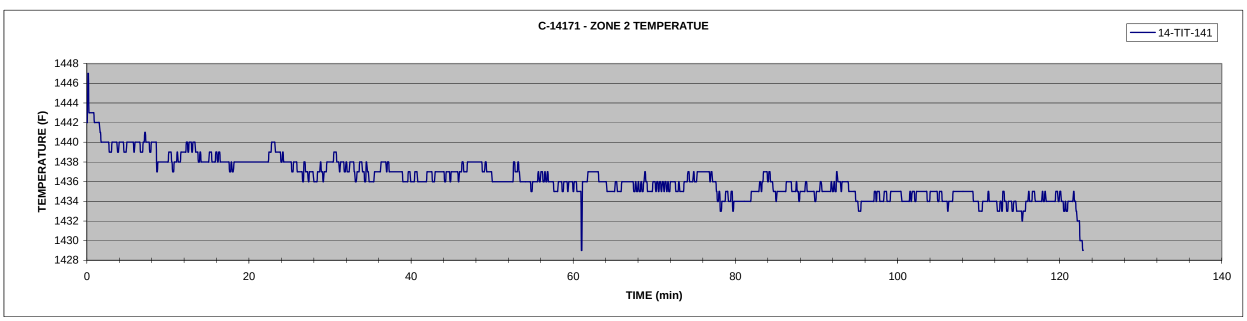


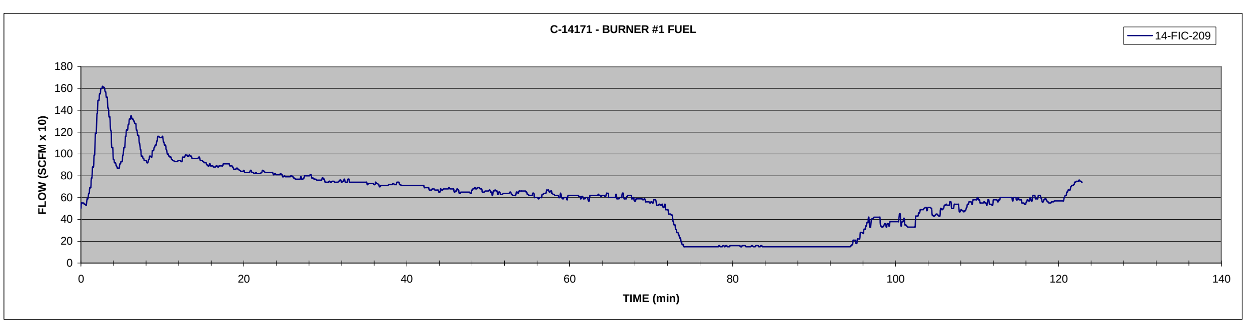
Appendix F – Child TC MPF Test # 6 (page 2 of 3)



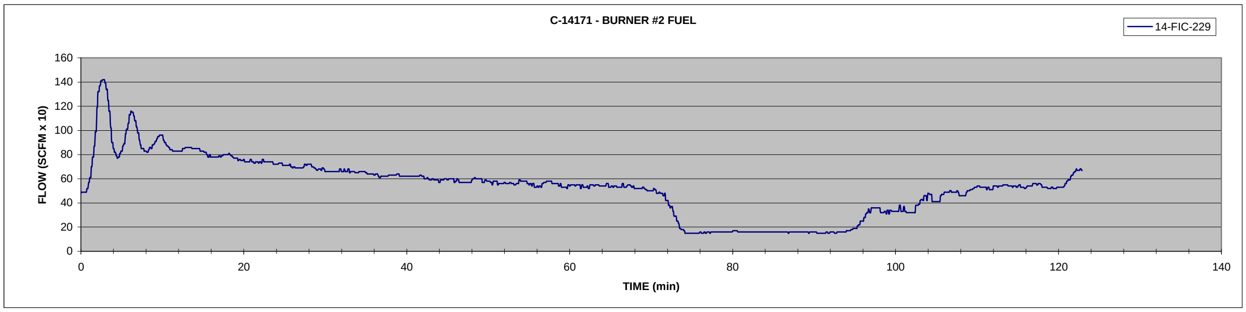


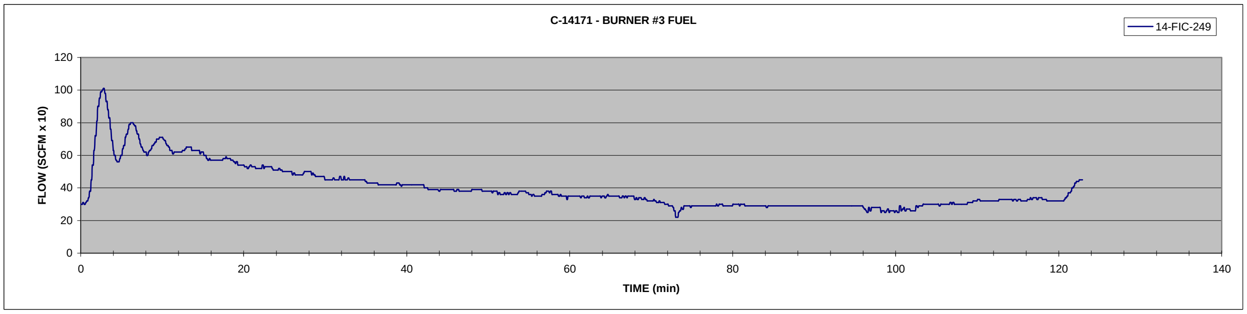


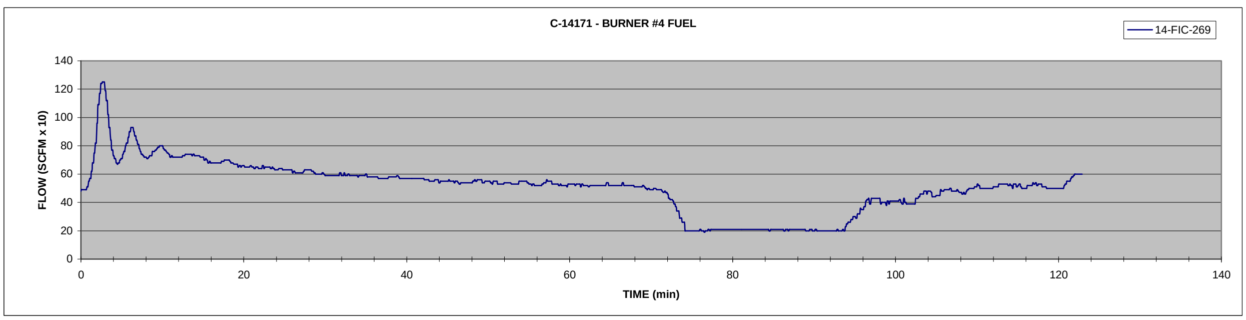


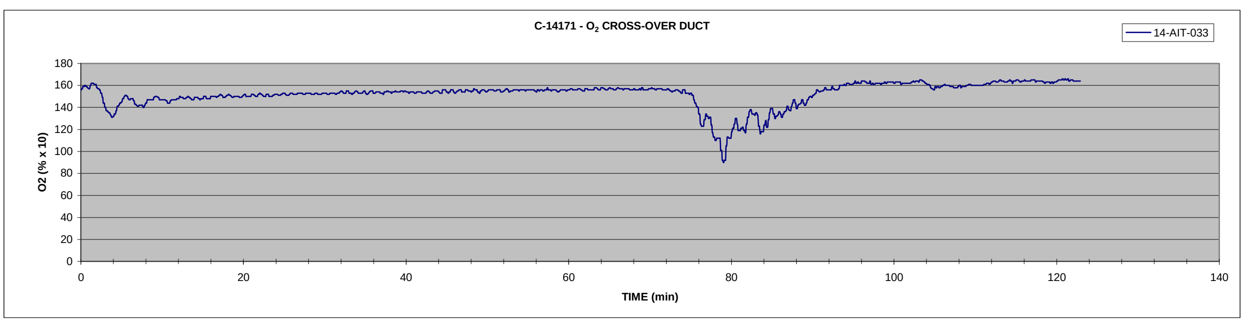


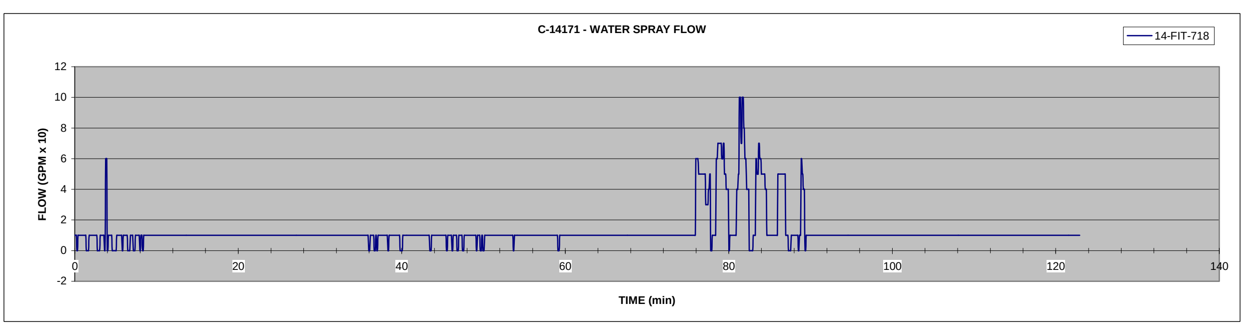
Appendix F – Child TC MPF Test # 6 (page 3 of 3)



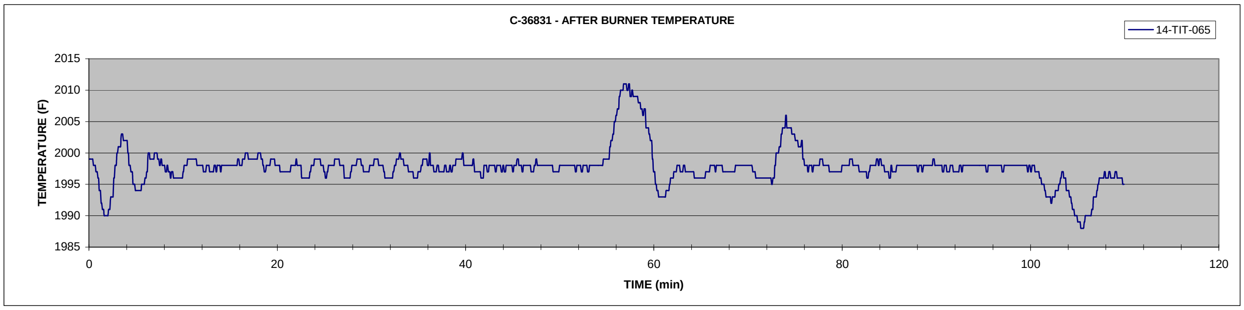


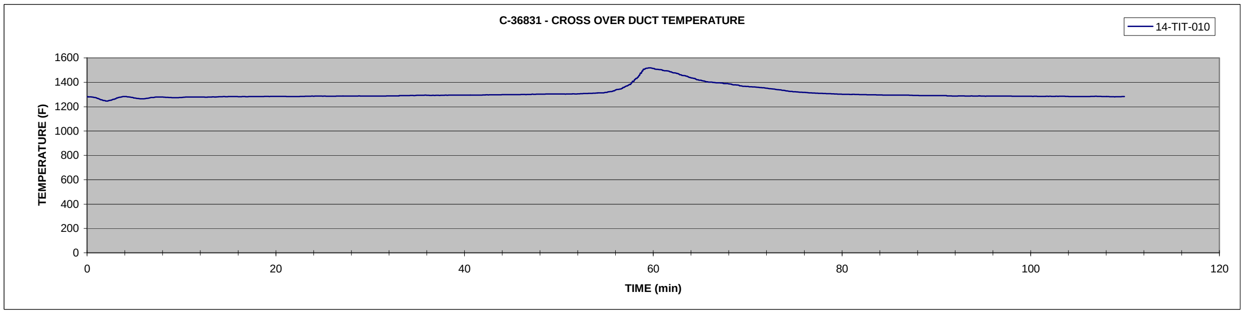


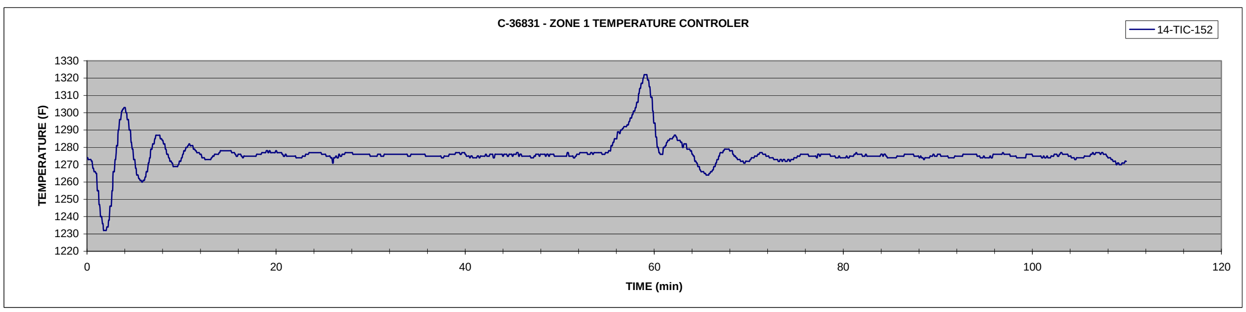


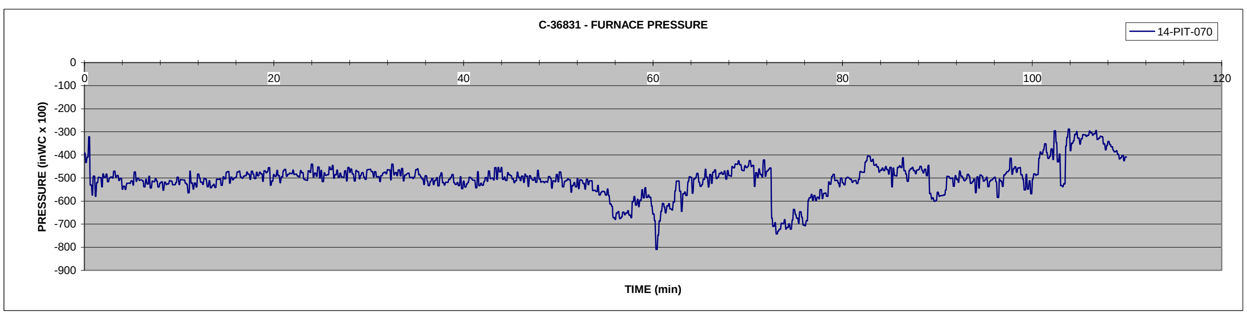


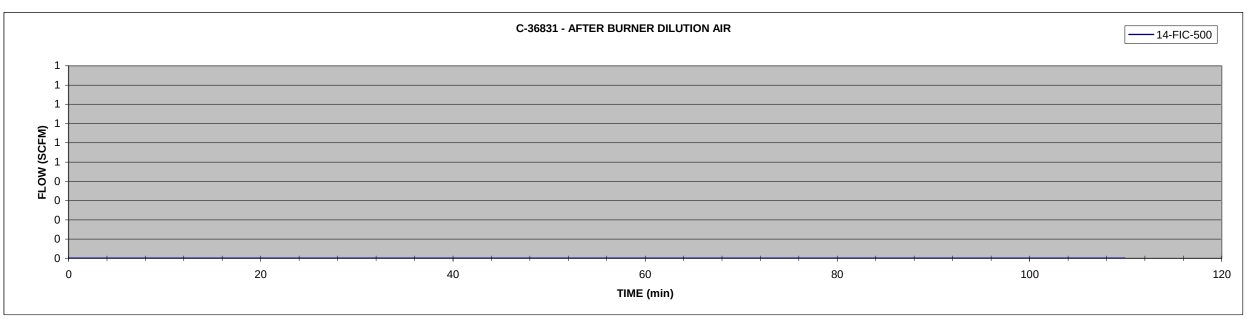
Appendix F – Child TC MPF Test # 7 (page 1 of 3)

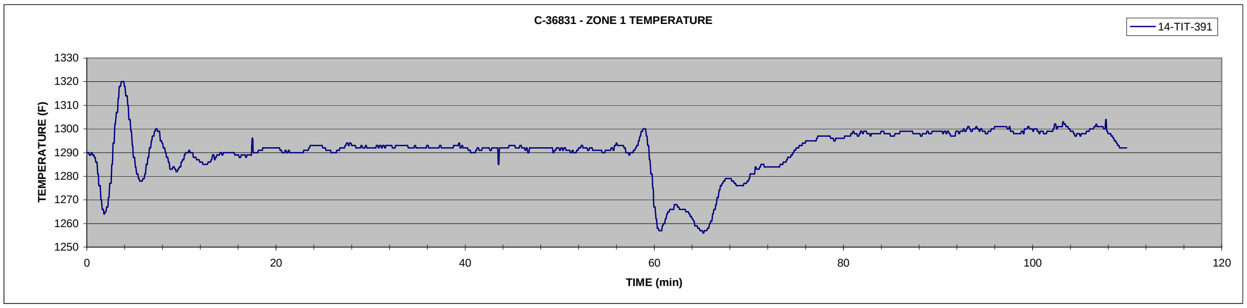




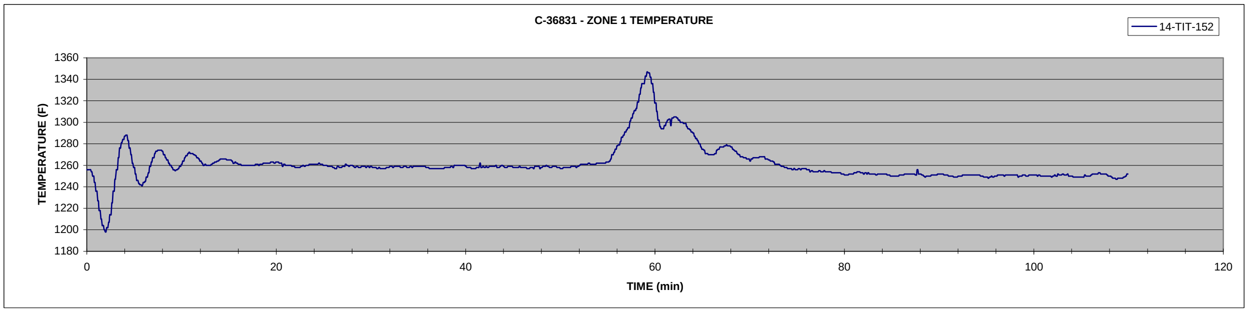




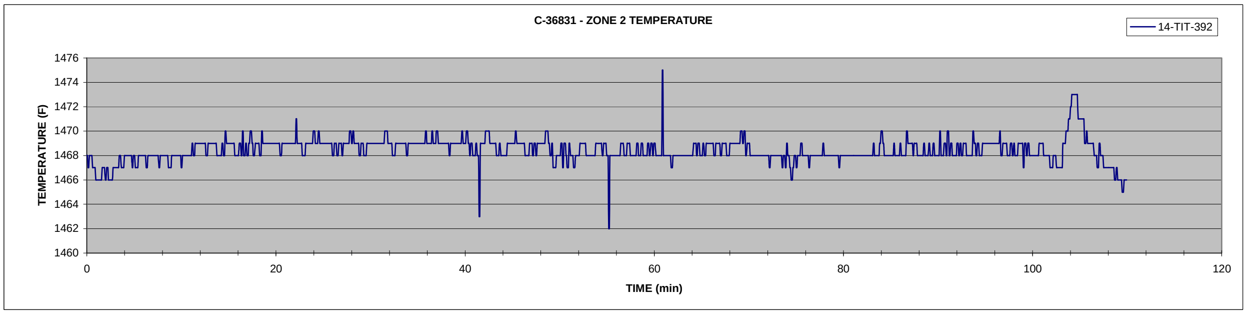




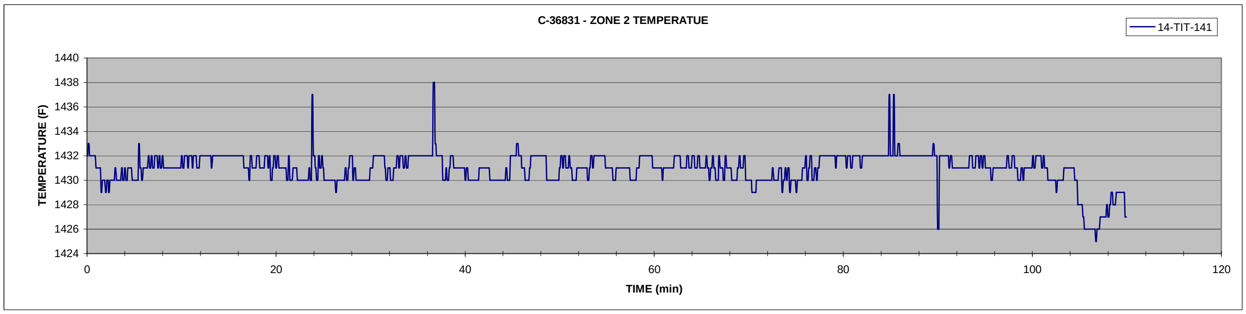
C-36831 - ZONE 1 TEMPERATURE
14-TIT-391
TEMPERATURE (F)
1330
1320
1310
1300
1290
1280
1270
1260
1250
0
20
40
60
80
100
120
TIME (min)



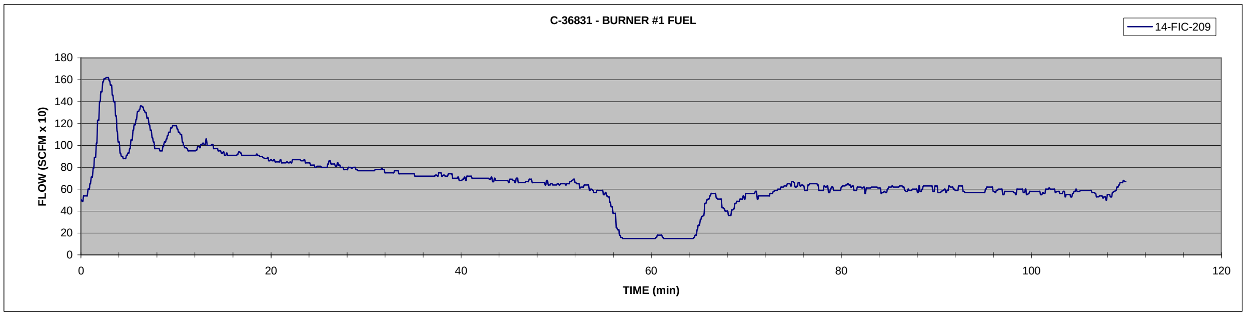
C-36831 - ZONE 1 TEMPERATURE
14-TIT-152
TEMPERATURE (F)
1360
1340
1320
1300
1280
1260
1240
1220
1200
1180
0
20
40
60
80
100
120
TIME (min)



C-36831 - ZONE 2 TEMPERATURE
14-TIT-392
TEMPERATURE (F)
1476
1474
1472
1470
1468
1466
1464
1462
1460
0
20
40
60
80
100
120
TIME (min)

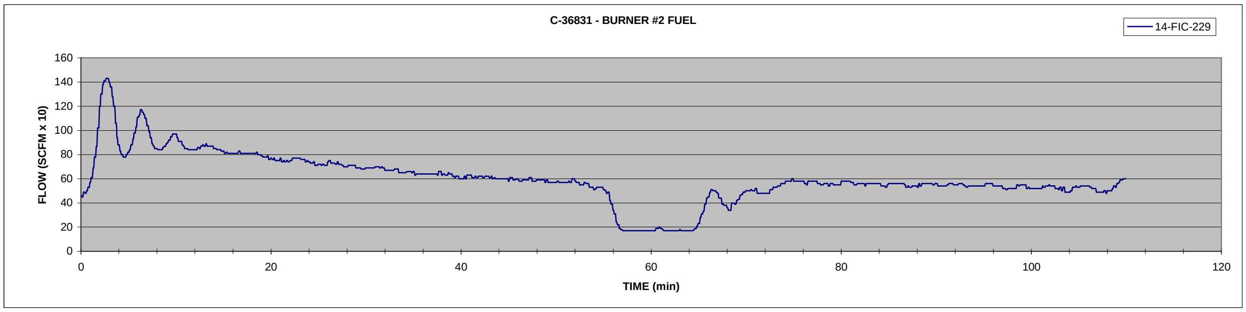


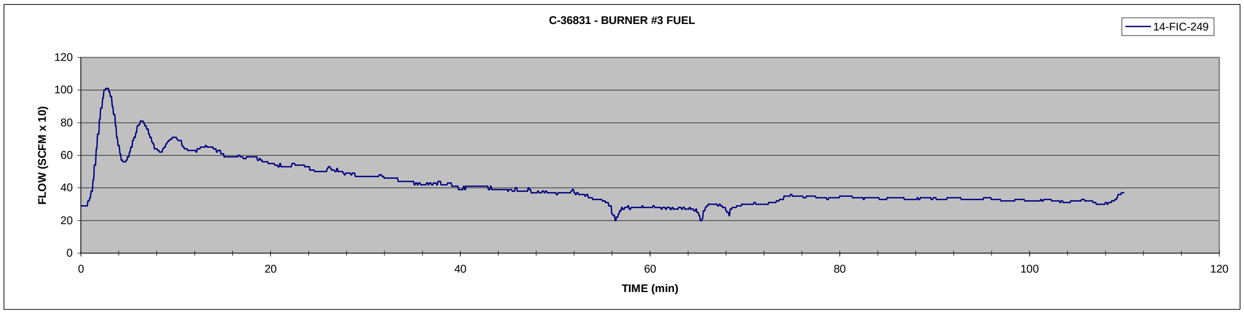
C-36831 - ZONE 2 TEMPERATUE
14-TIT-141
TEMPERATURE (F)
1440
1438
1436
1434
1432
1430
1428
1426
1424
0
20
40
60
80
100
120
TIME (min)

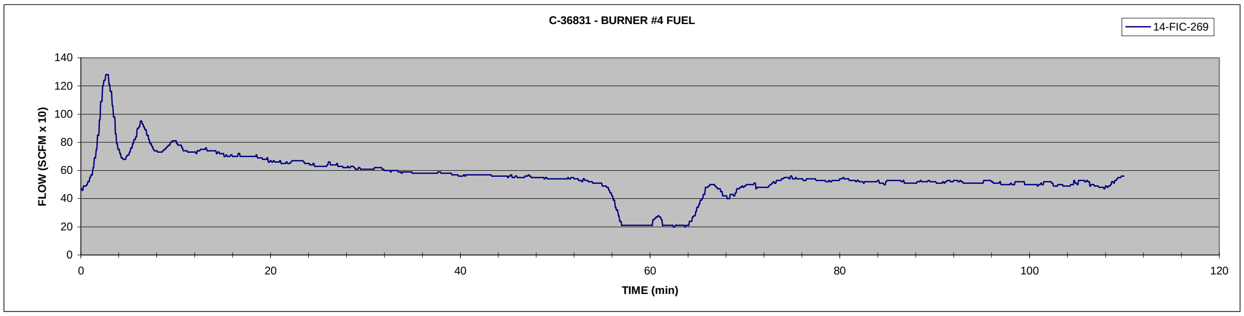


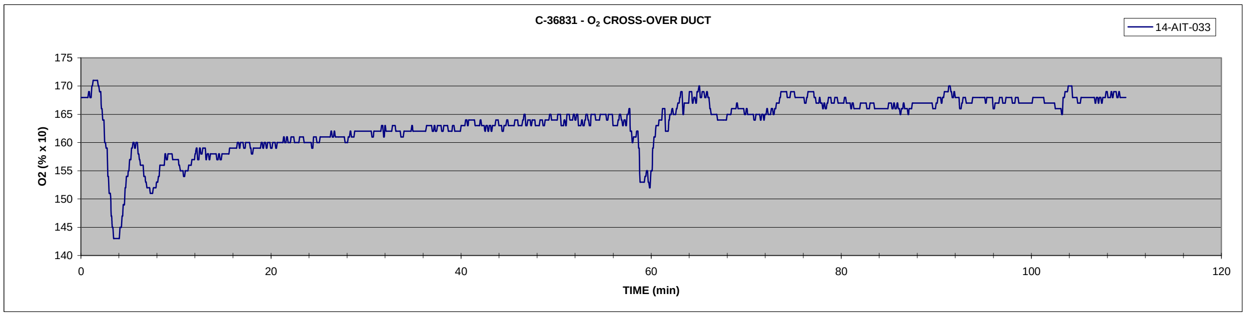
C-36831 - BURNER #1 FUEL
14-FIC-209
FLOW (SCFM x 10)
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
TIME (min)

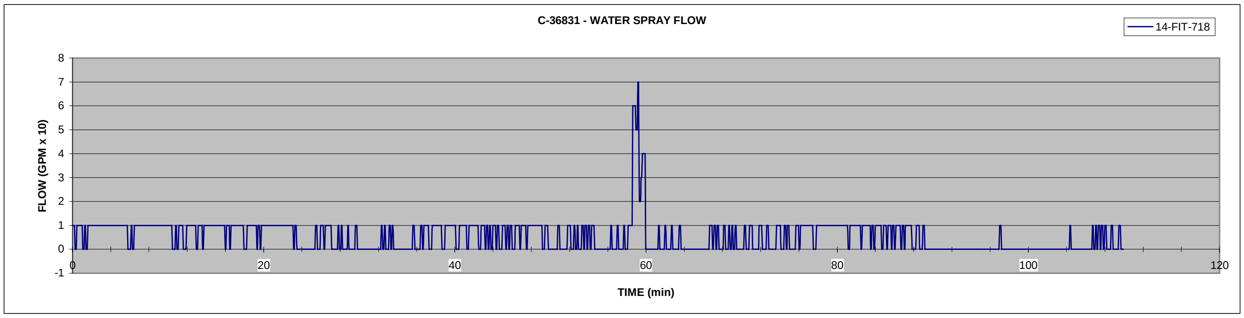
Appendix F – Child TC MPF Test # 7 (page 3 of 3)



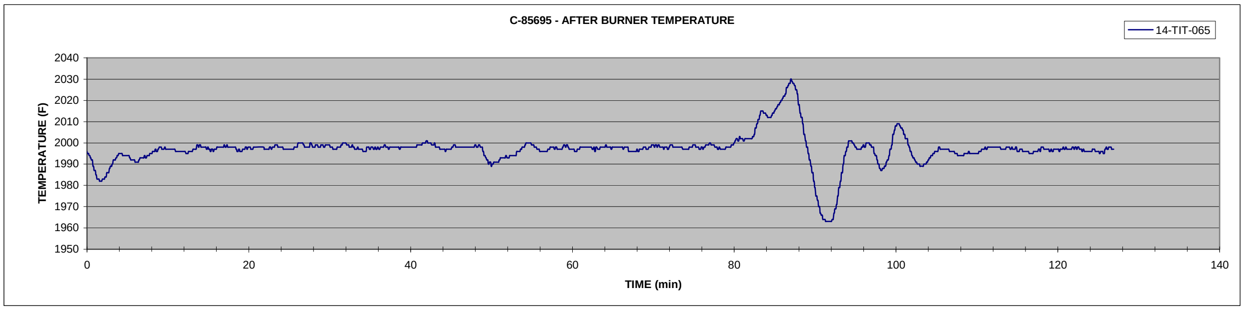


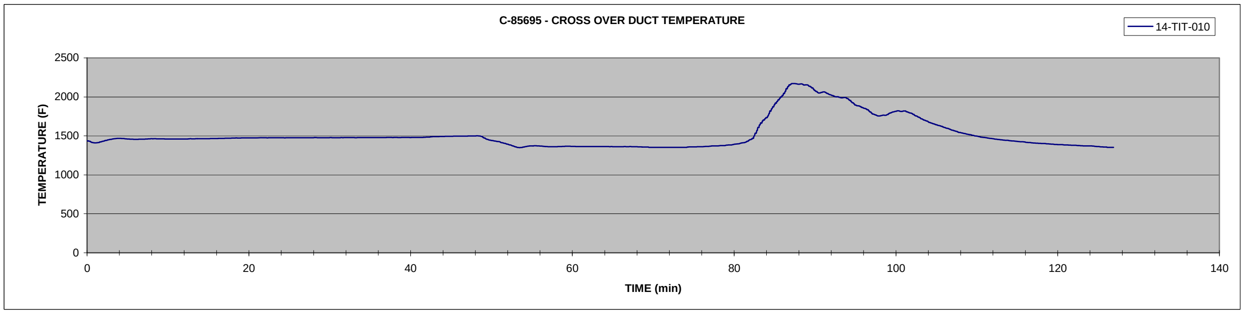


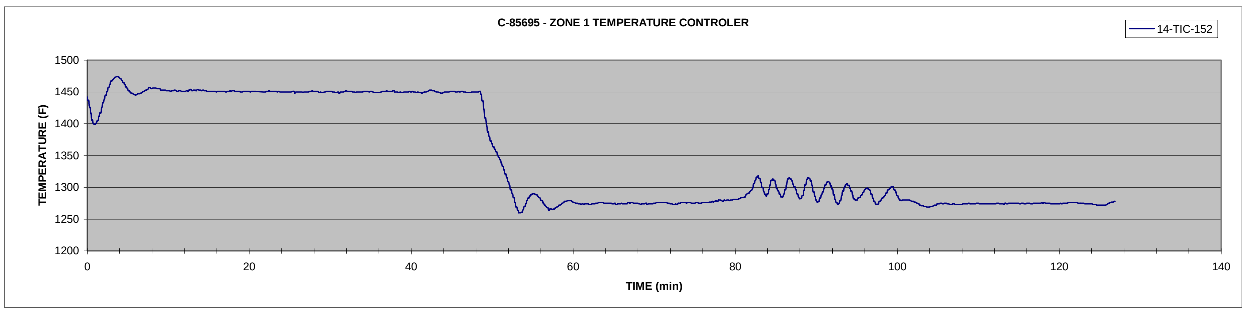


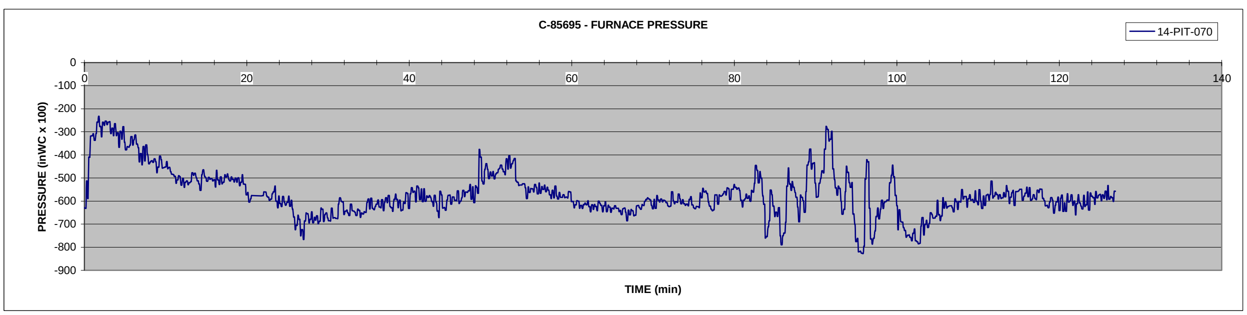


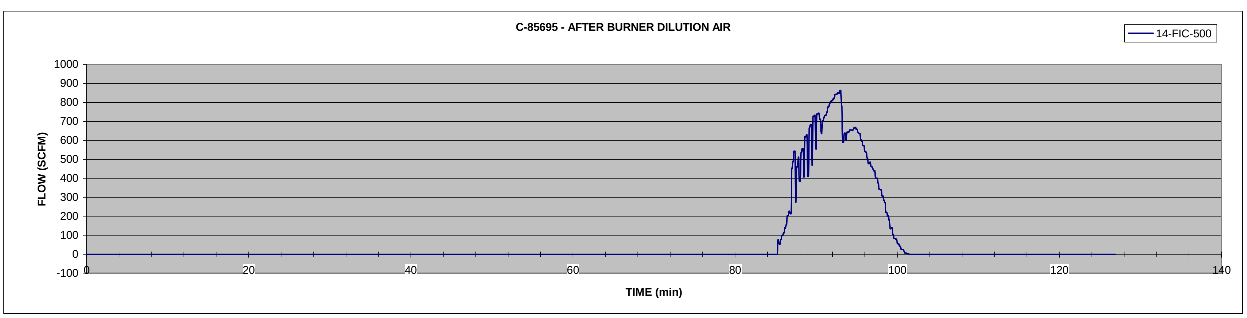
Appendix F – Child TC MPF Test # 8 (page 1 of 3)



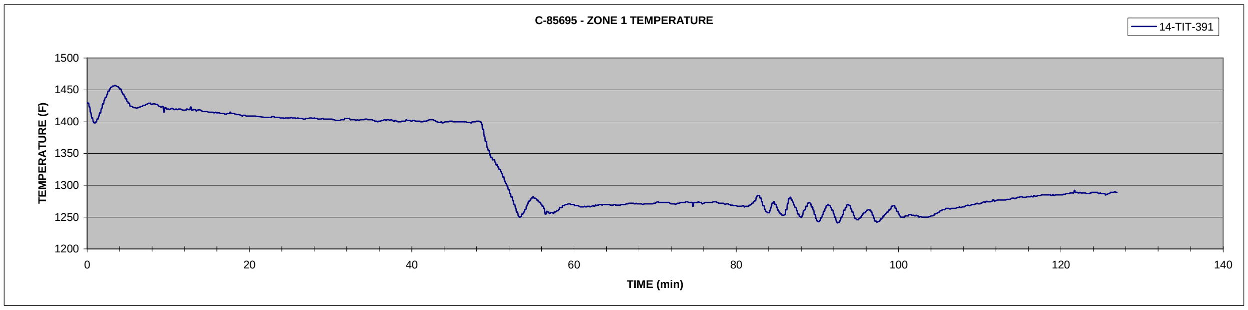


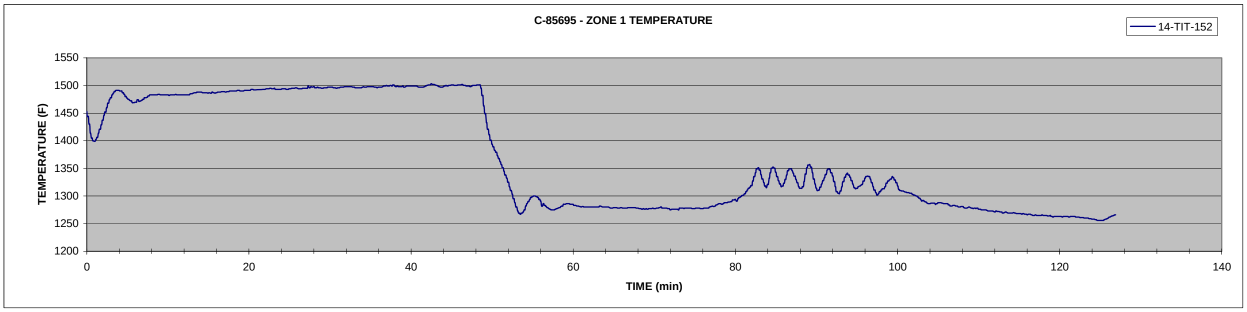


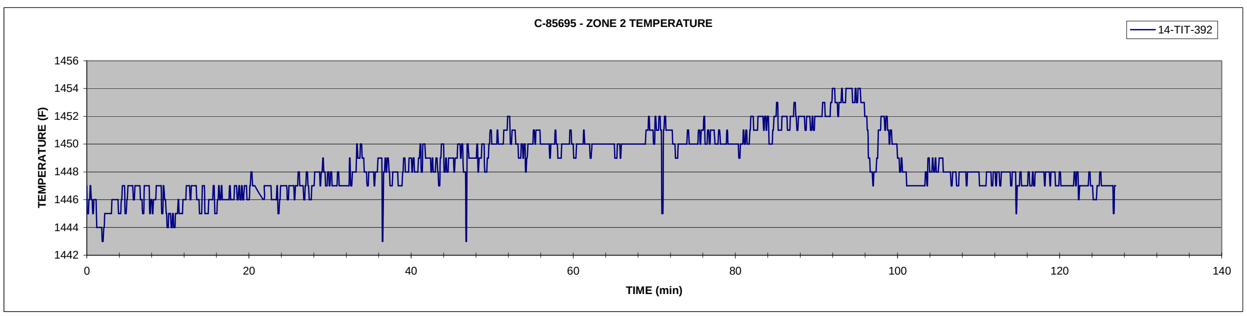


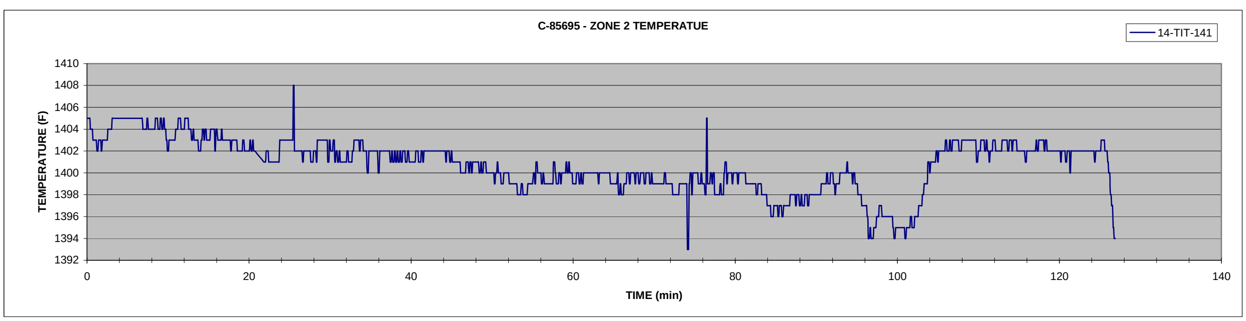


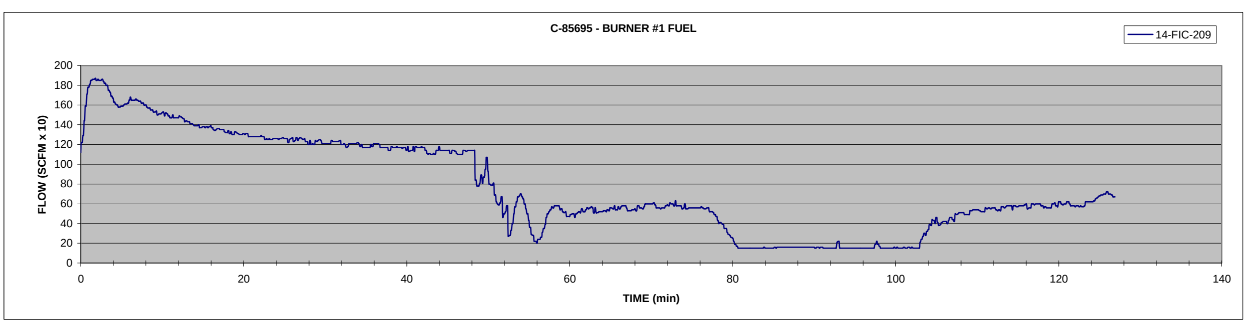
Appendix F – Child TC MPF Test # 8 (page 2 of 3)



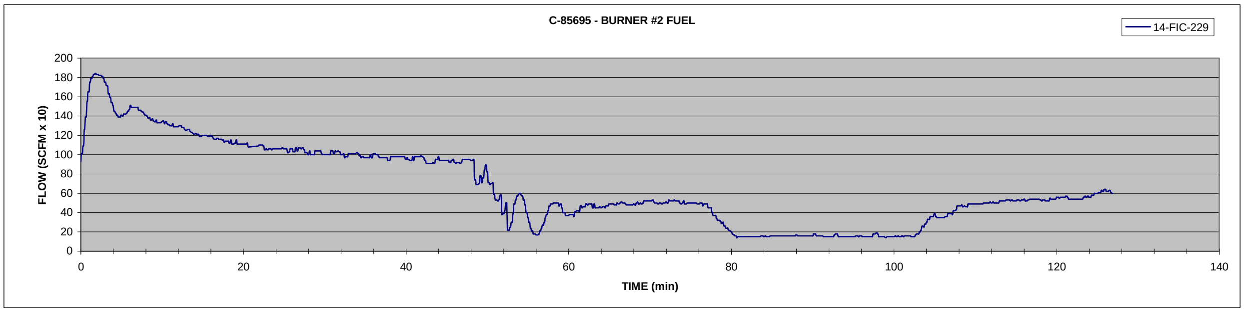


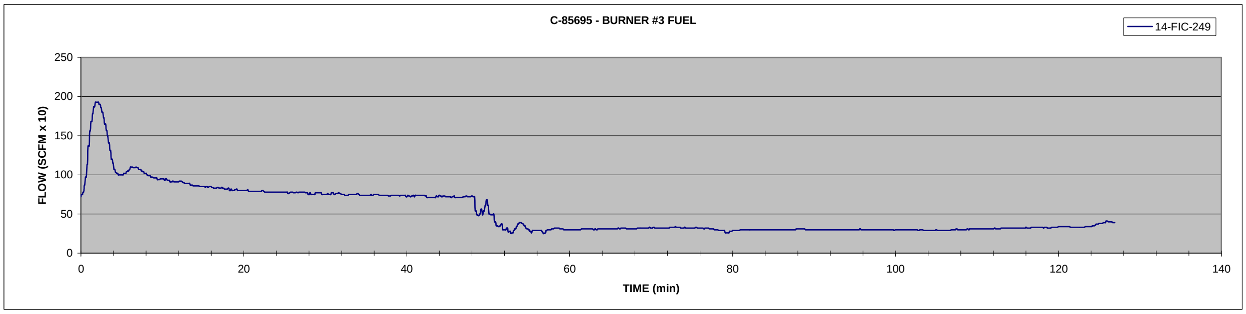


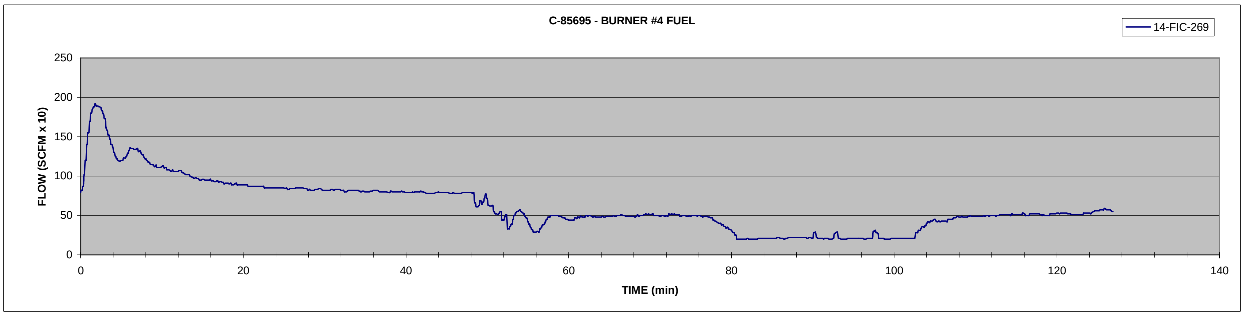


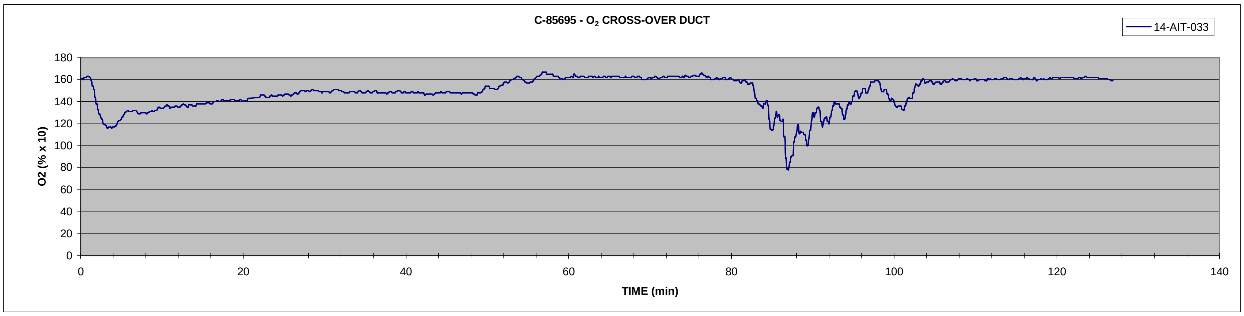


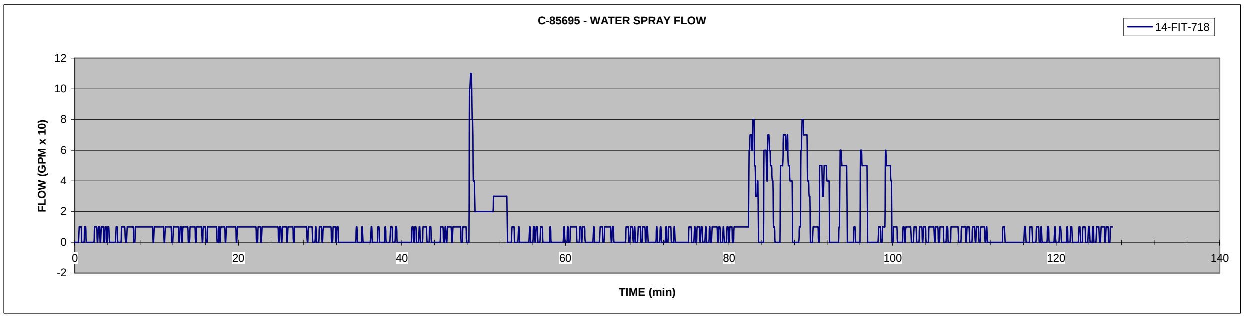
Appendix F – Child TC MPF Test # 8 (page 3 of 3)

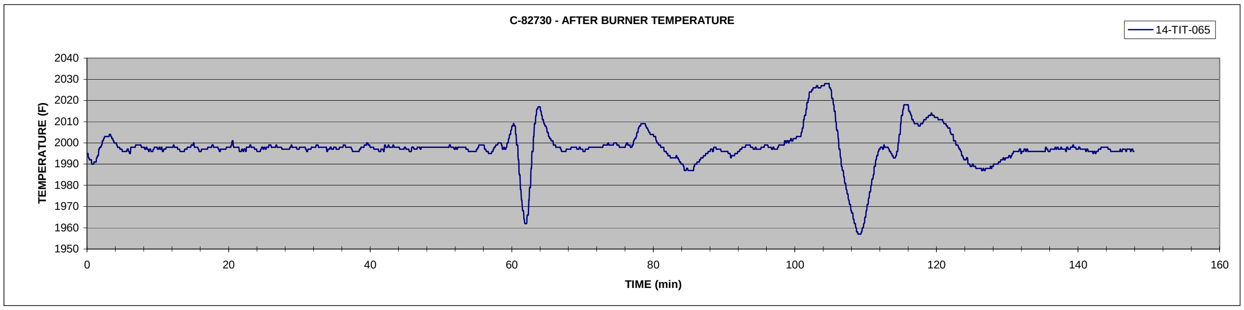


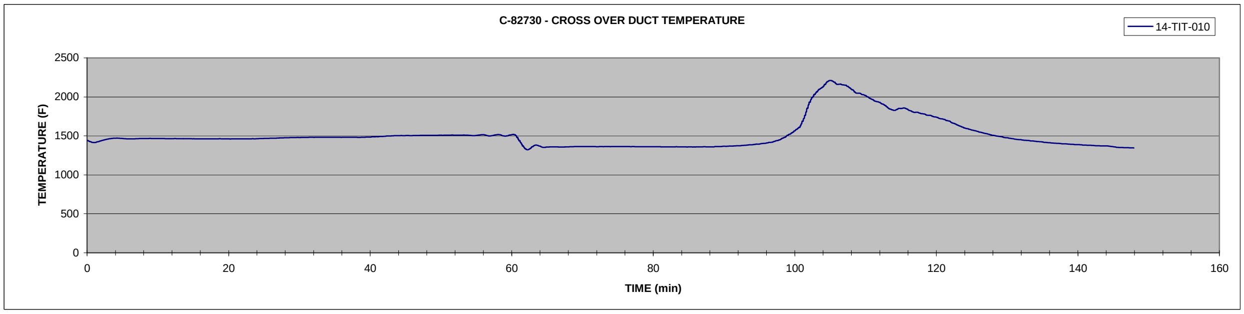


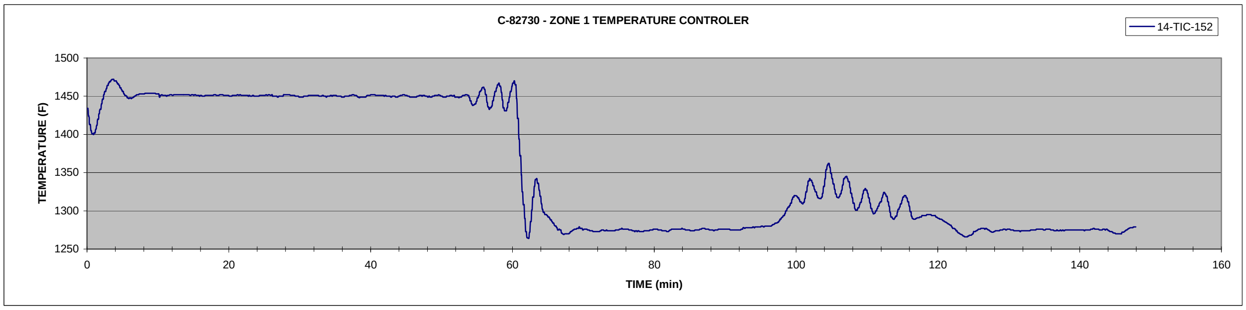


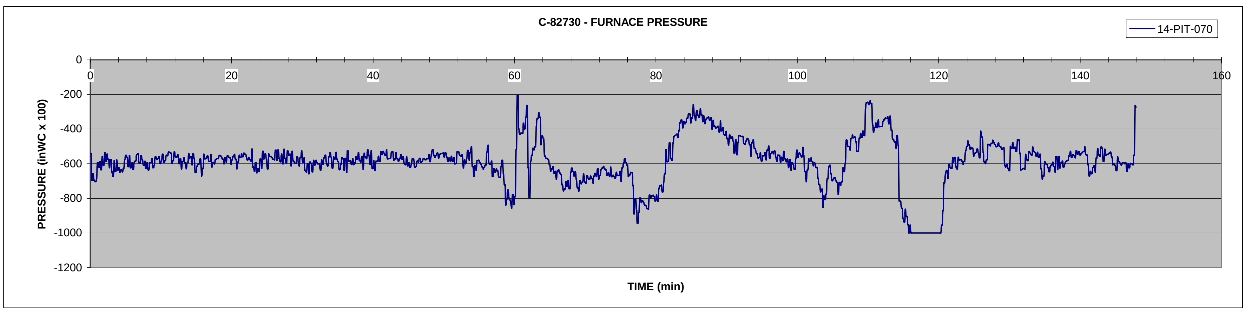


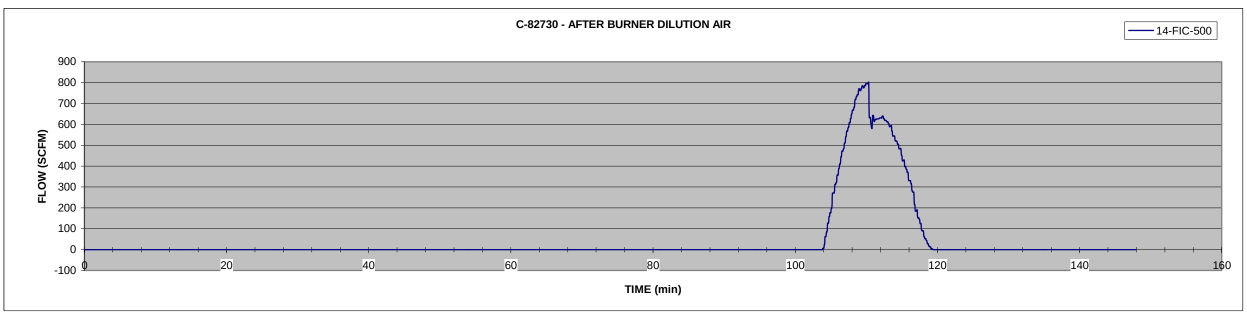



C-82730 - AFTER BURNER TEMPERATURE
14-TIT-065
TEMPERATURE (F)
2040
2030
2020
2010
2000
1990
1980
1970
1960
1950
0
20
40
60
80
100
120
140
160
TIME (min)

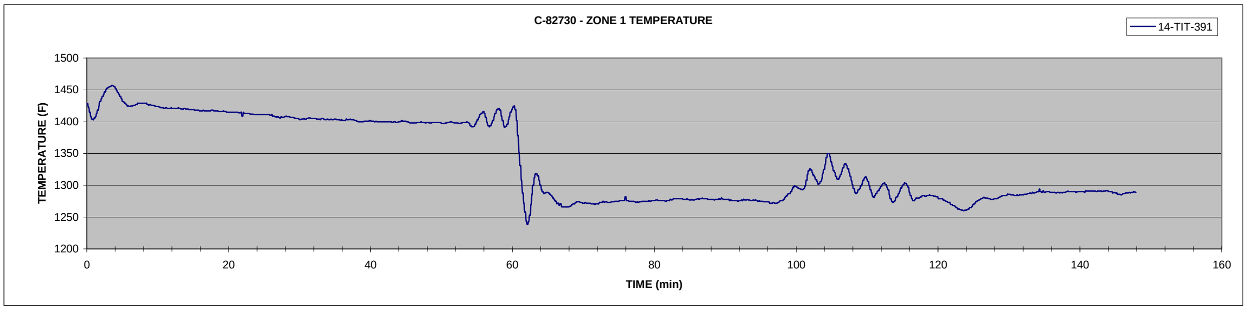

C-82730 - CROSS OVER DUCT TEMPERATURE
14-TIT-010
TEMPERATURE (F)
2500
2000
1500
1000
500
0
0
20
40
60
80
100
120
140
160
TIME (min)

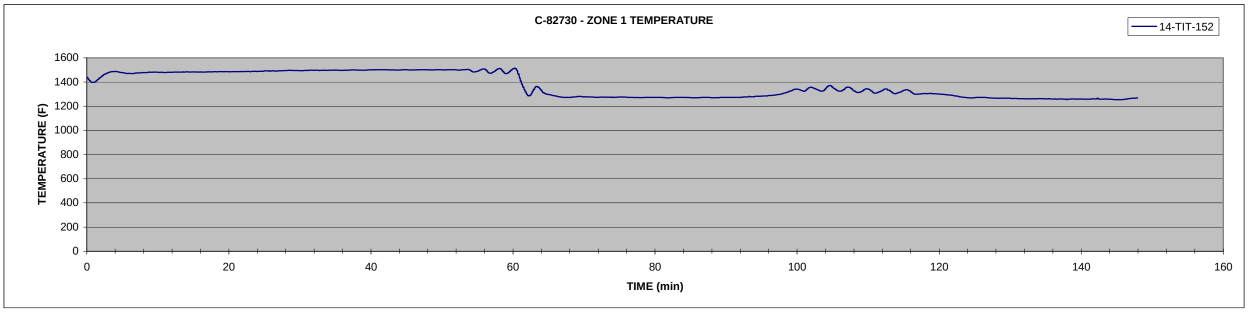

C-82730 - ZONE 1 TEMPERATURE CONTROLER
14-TIC-152
TEMPERATURE (F)
1500
1450
1400
1350
1300
1250
0
20
40
60
80
100
120
140
160
TIME (min)

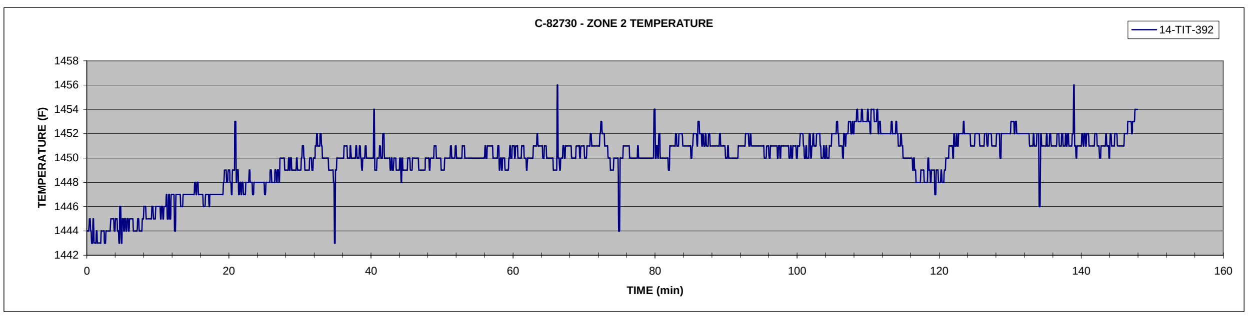

C-82730 - FURNACE PRESSURE
14-PIT-070
PRESSURE (inWC x 100)
0
-200
-400
-600
-800
-1000
-1200
0
20
40
60
80
100
120
140
160
TIME (min)

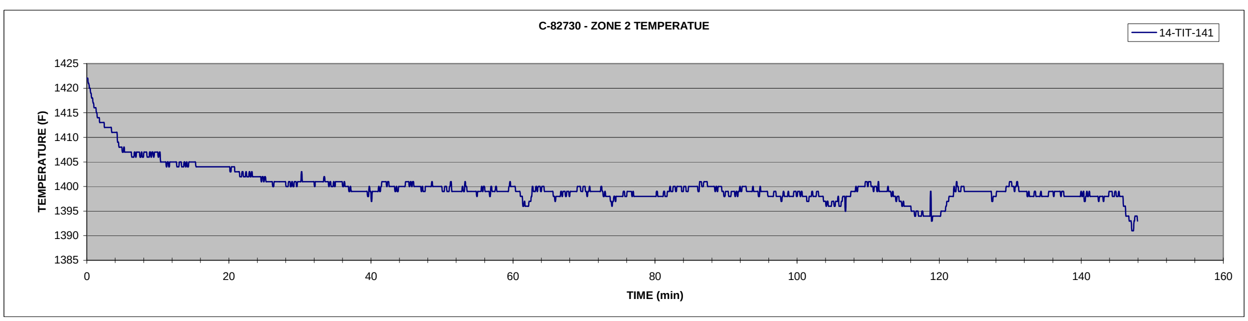

C-82730 - AFTER BURNER DILUTION AIR
14-FIC-500
FLOW (SCFM)
900
800
700
600
500
400
300
200
100
0
-100
0
20
40
60
80
100
120
140
160
TIME (min)

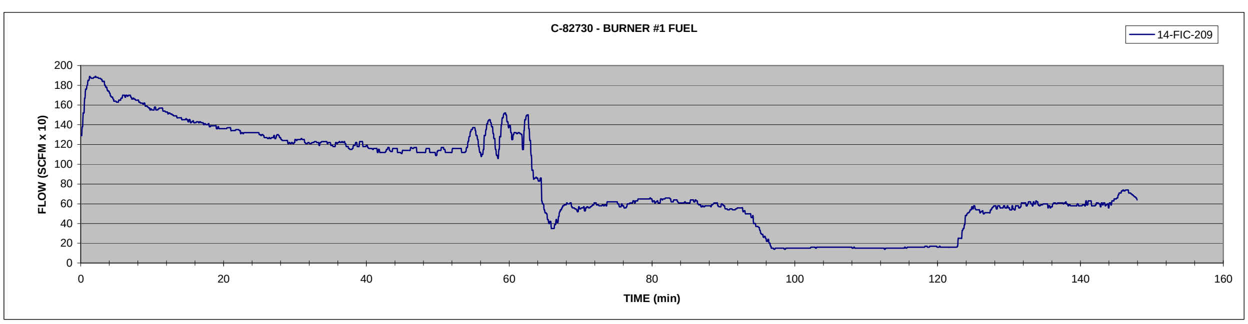
Appendix F – Child TC MPF Test # 9 (page 2 of 3)



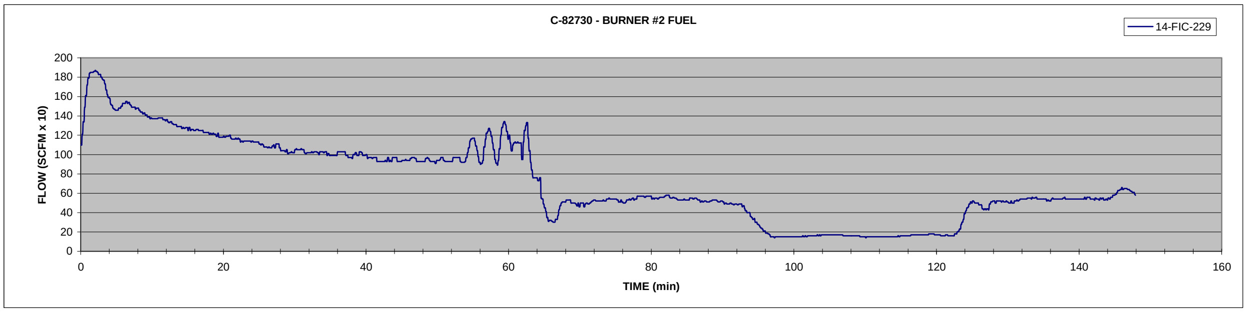


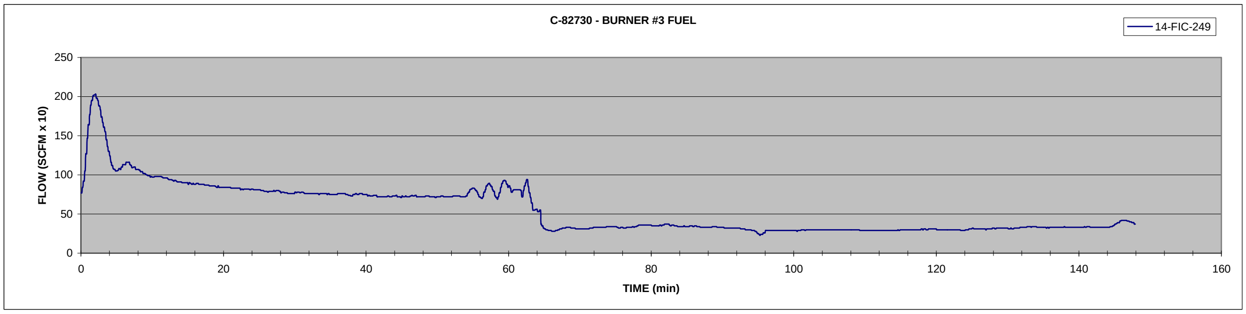


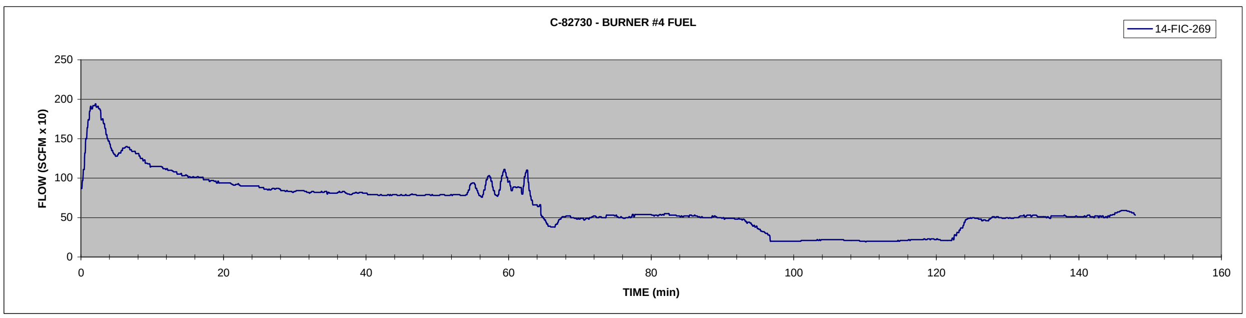


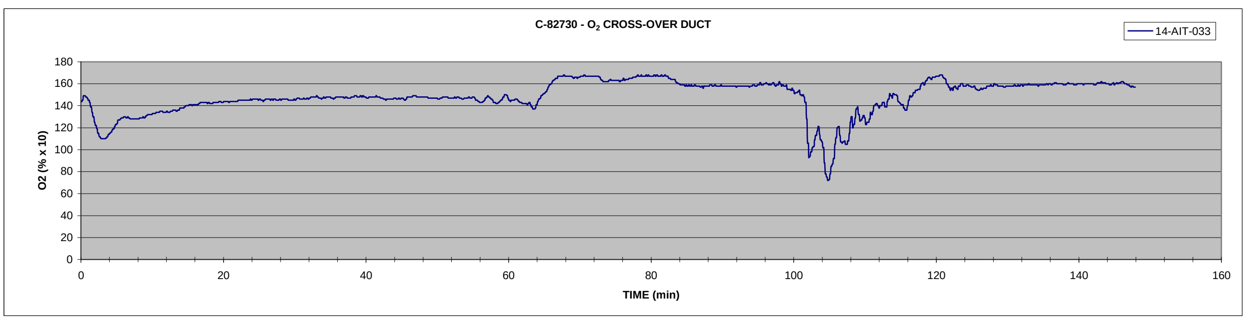


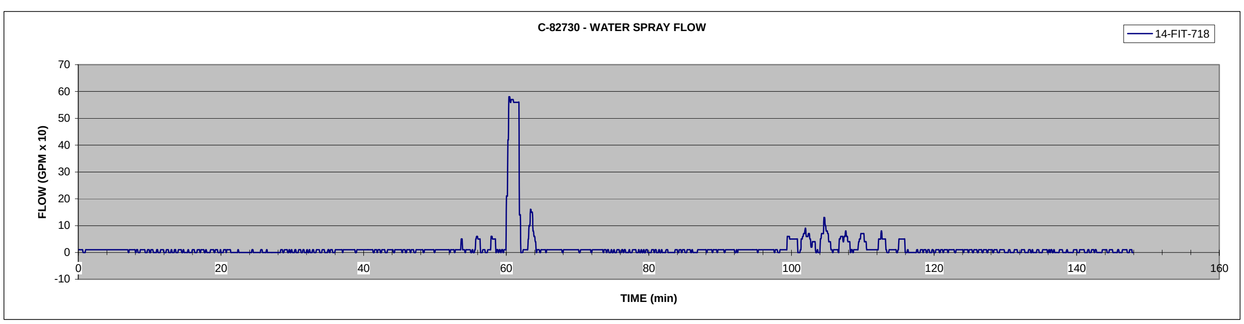
Appendix F – Child TC MPF Test # 9 (page 3 of 3)



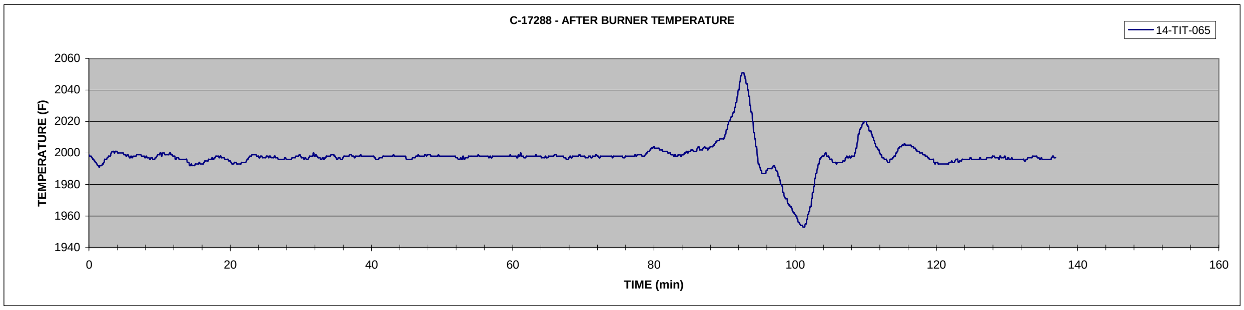


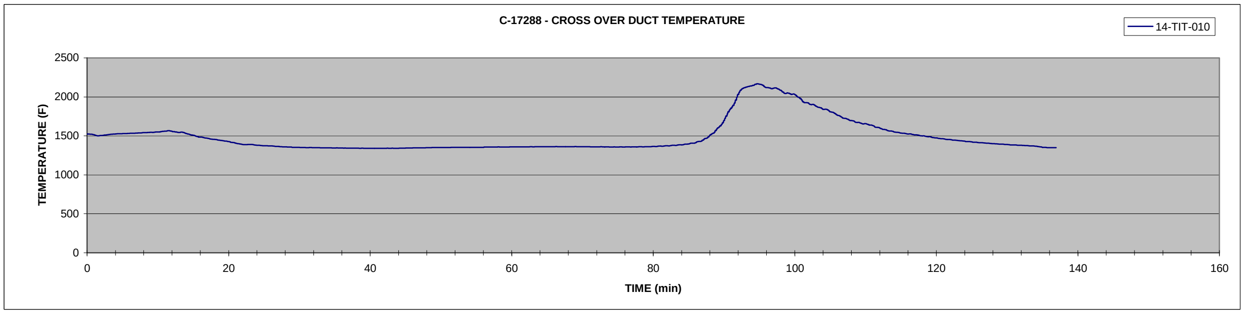


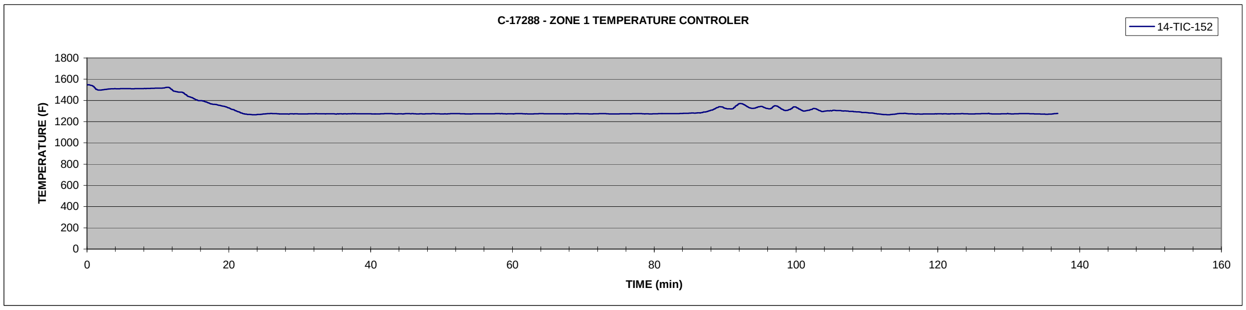


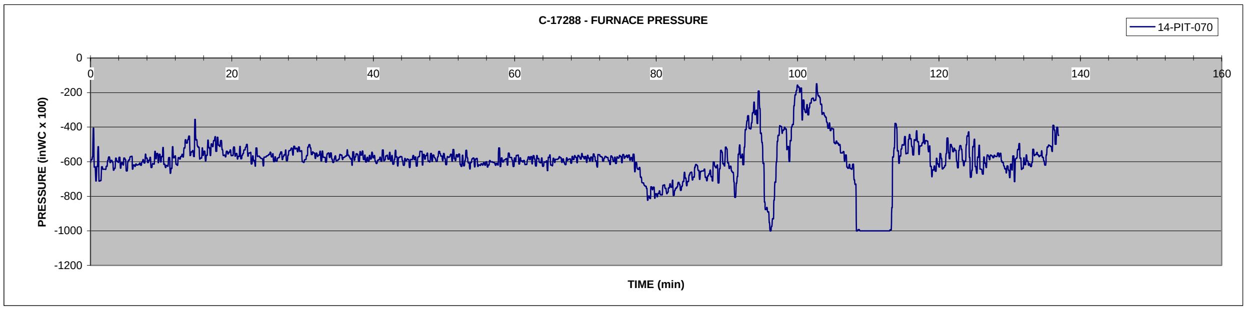


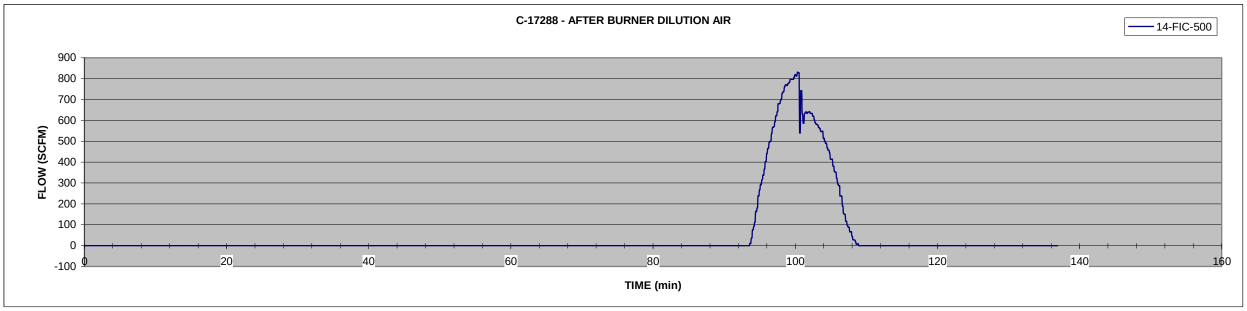
Appendix F – Child TC MPF Test # 10 (page 1 of 3)

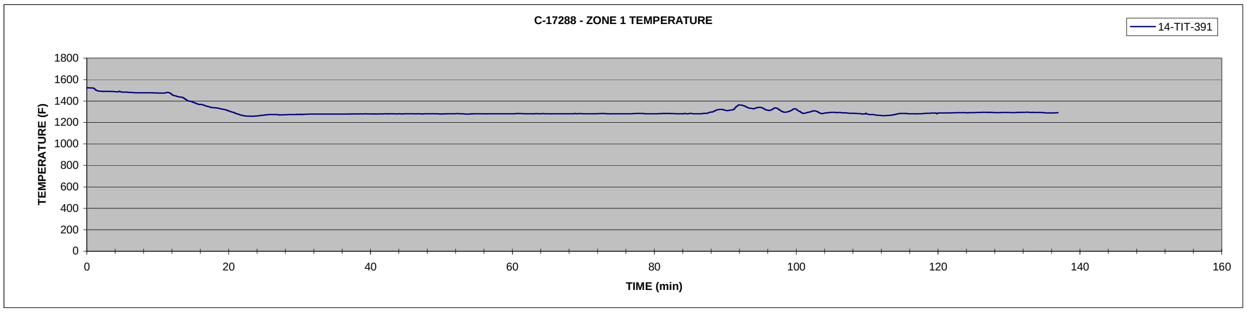


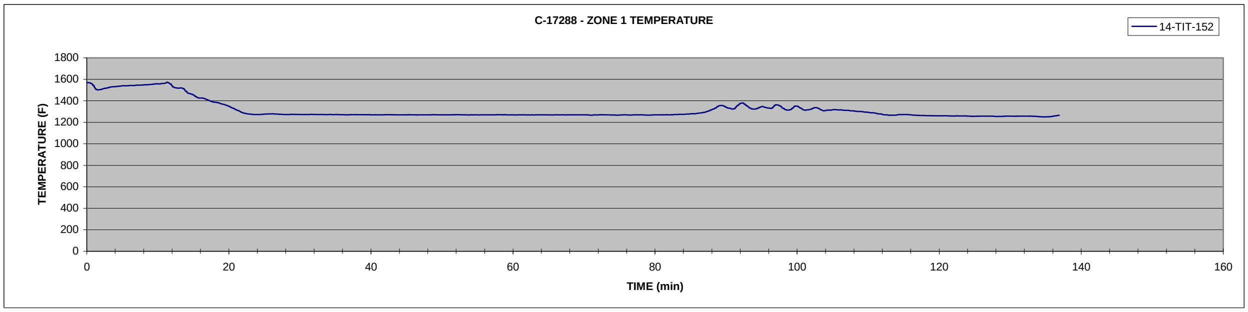


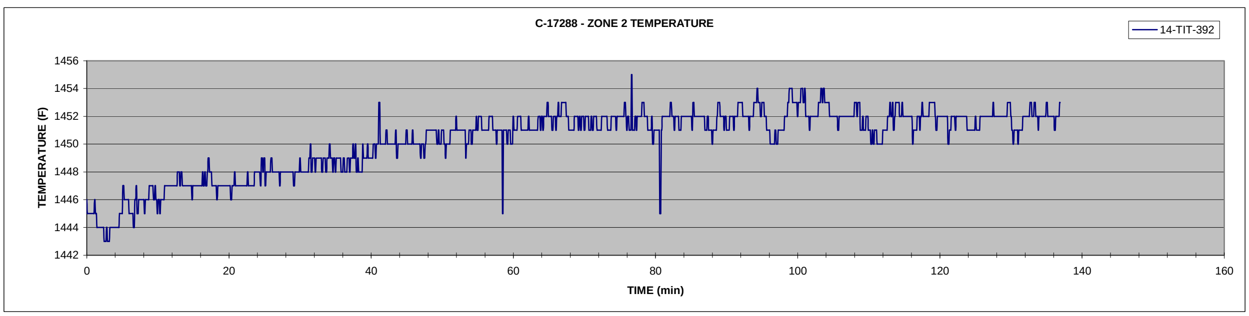


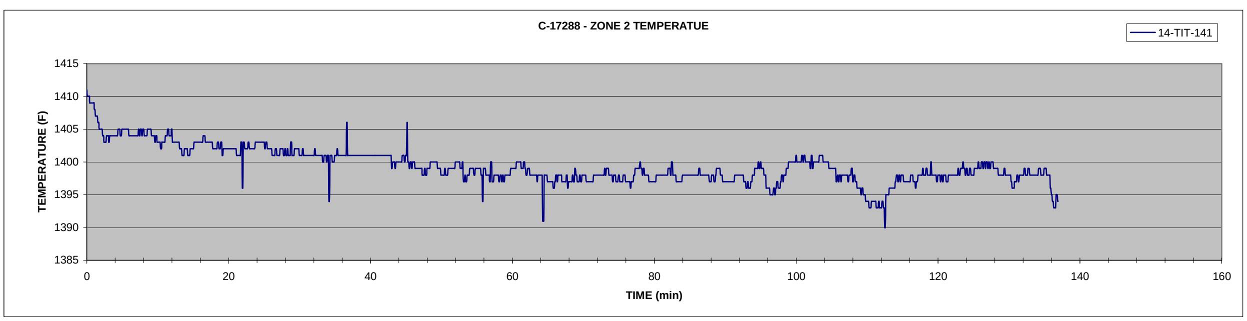


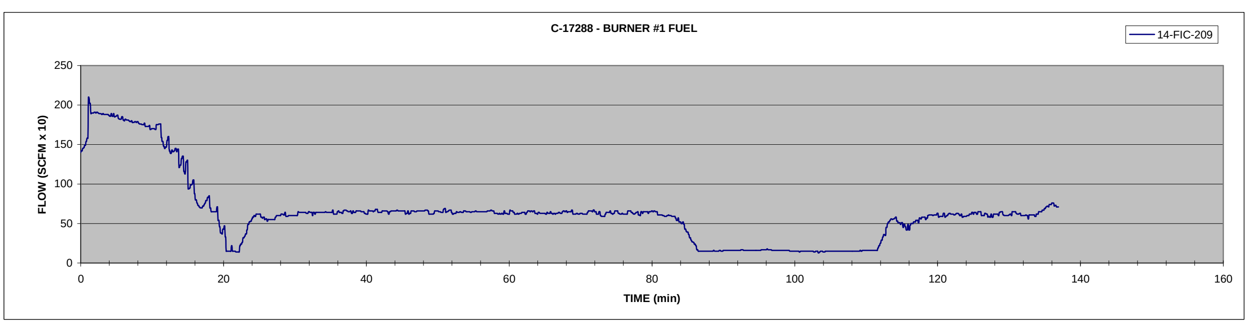



C-17288 - ZONE 1 TEMPERATURE
14-TIT-391
TEMPERATURE (F)
1800
1600
1400
1200
1000
800
600
400
200
0
0
20
40
60
80
100
120
140
160
TIME (min)

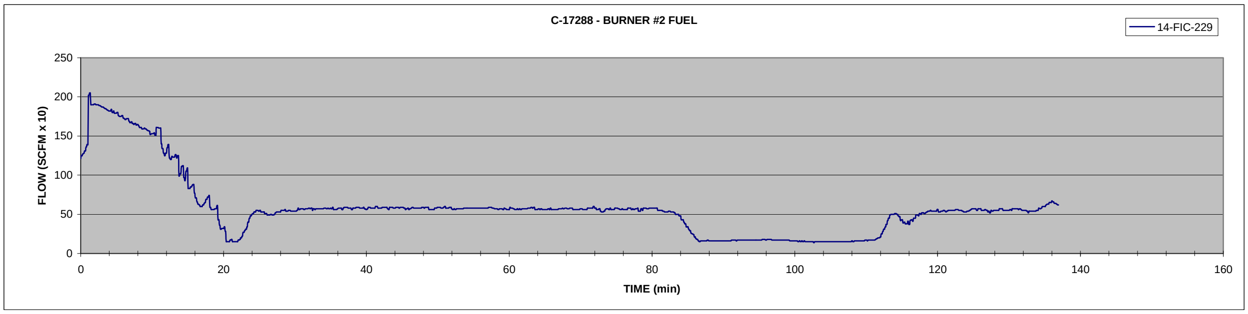

C-17288 - ZONE 1 TEMPERATURE
14-TIT-152
TEMPERATURE (F)
1800
1600
1400
1200
1000
800
600
400
200
0
0
20
40
60
80
100
120
140
160
TIME (min)

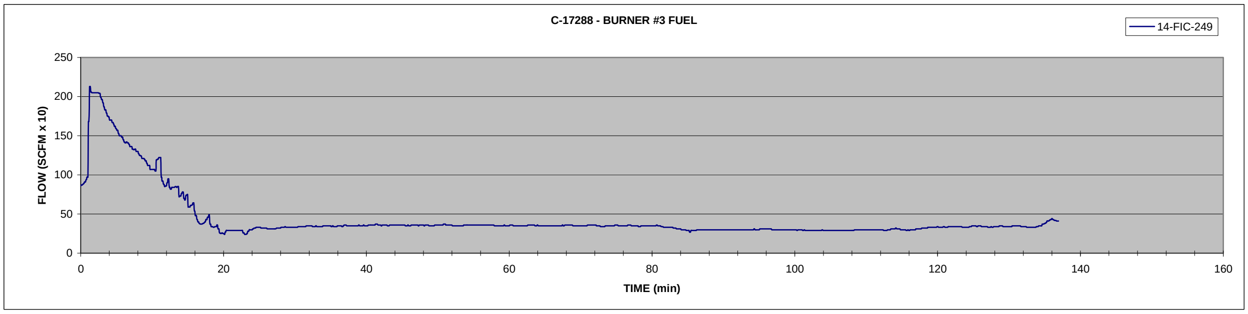

C-17288 - ZONE 2 TEMPERATURE
14-TIT-392
TEMPERATURE (F)
1456
1454
1452
1450
1448
1446
1444
1442
0
20
40
60
80
100
120
140
160
TIME (min)

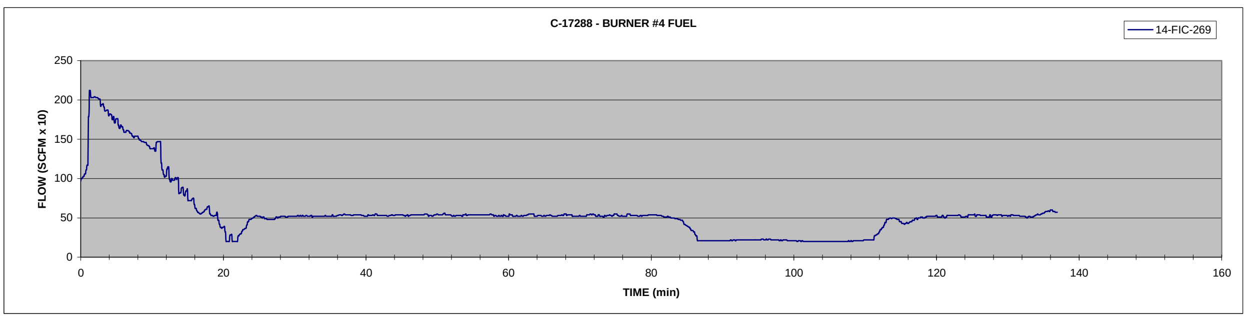

C-17288 - ZONE 2 TEMPERATUE
14-TIT-141
TEMPERATURE (F)
1415
1410
1405
1400
1395
1390
1385
0
20
40
60
80
100
120
140
160
TIME (min)

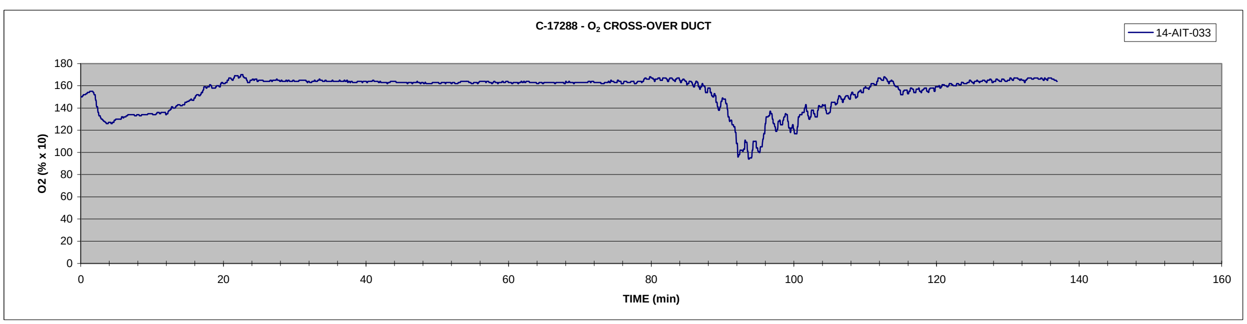

C-17288 - BURNER #1 FUEL
14-FIC-209
FLOW (SCFM x 10)
250
200
150
100
50
0
0
20
40
60
80
100
120
140
160
TIME (min)

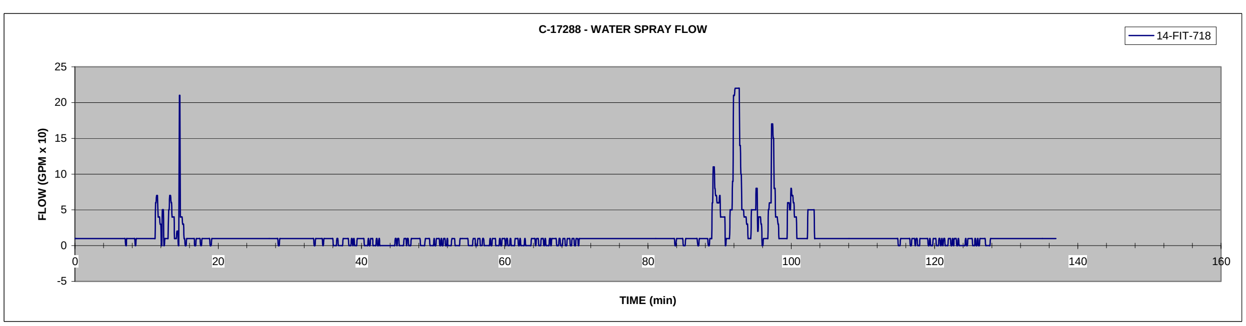
Appendix F – Child TC MPF Test # 10 (page 3 of 3)



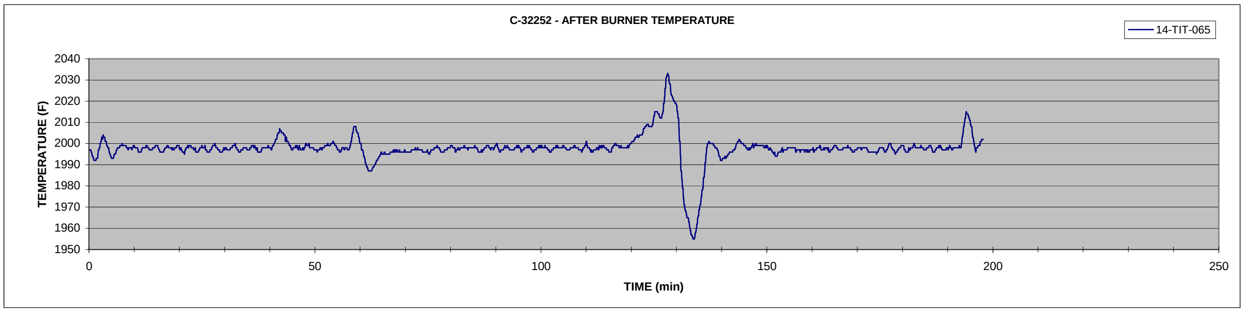


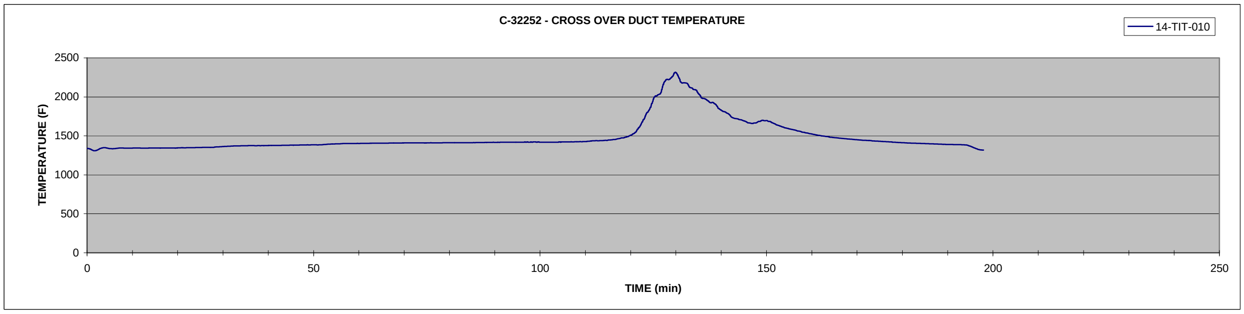


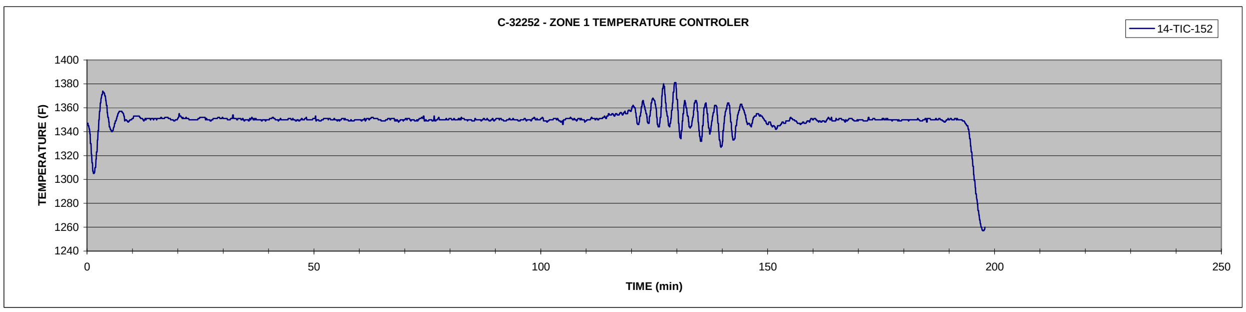


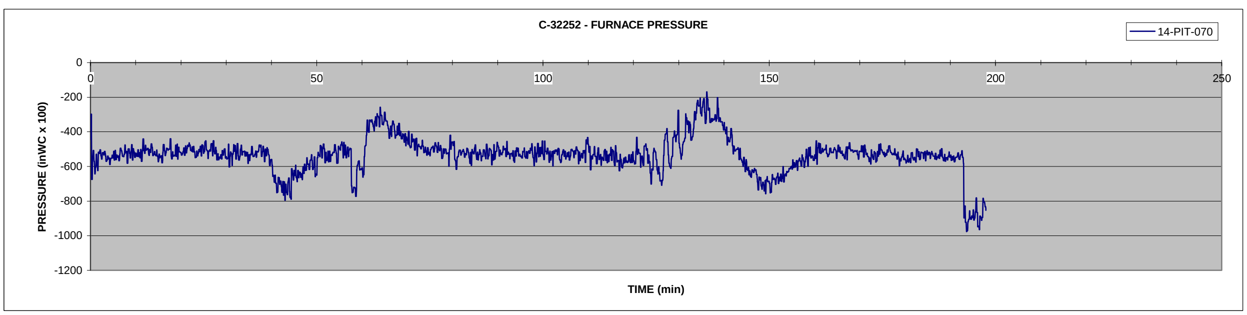


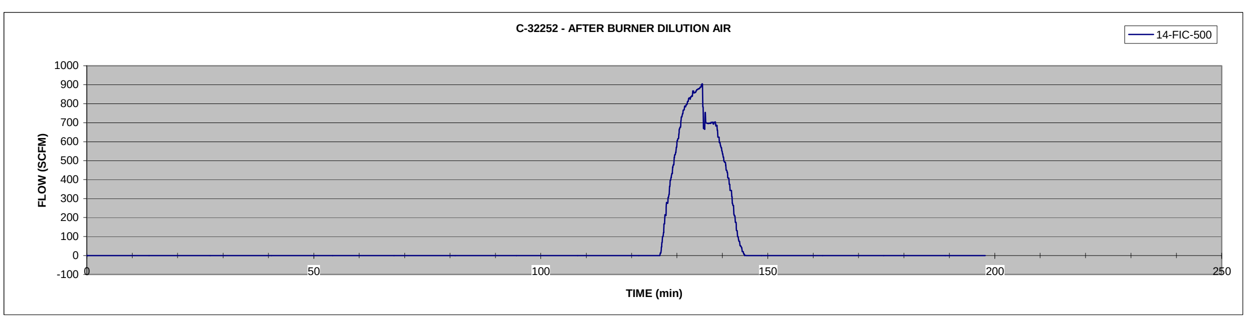
Appendix F – Child TC MPF Test # 11 (page 1 of 3)



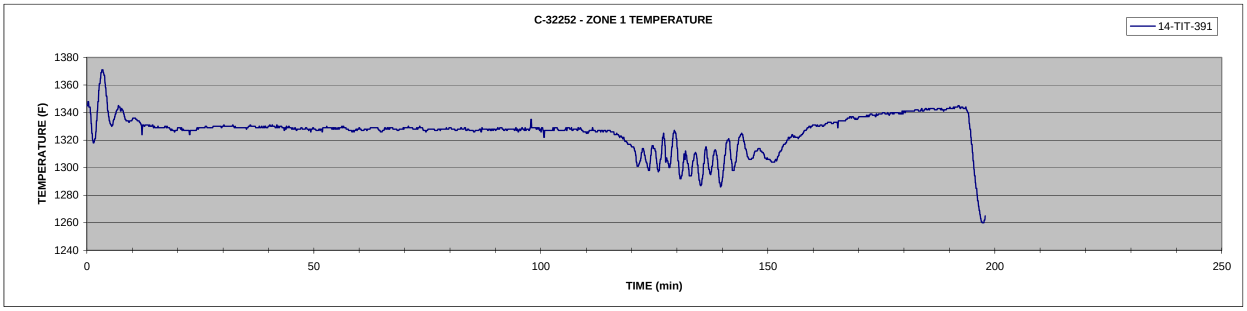


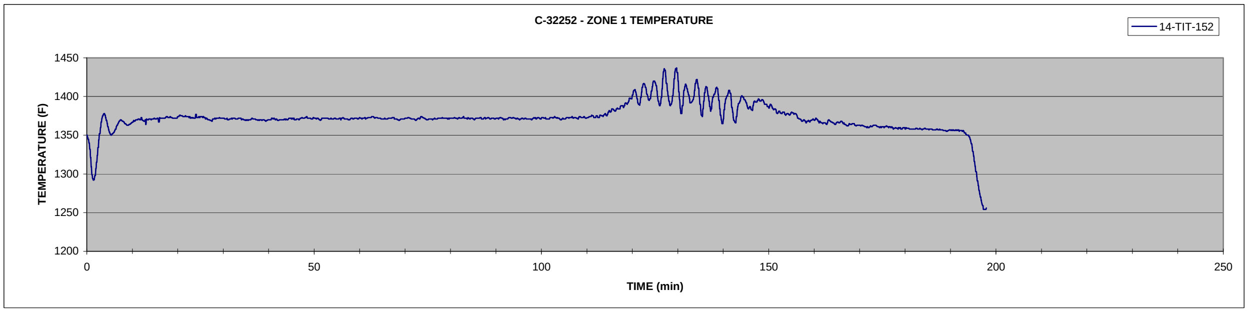


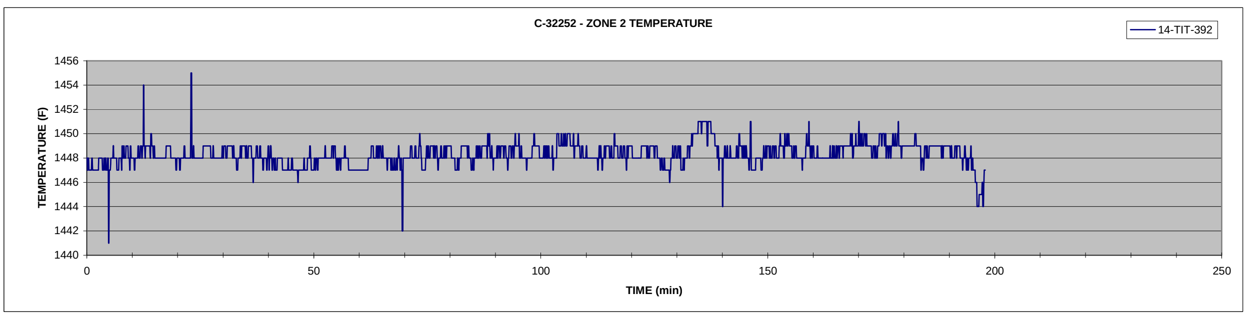


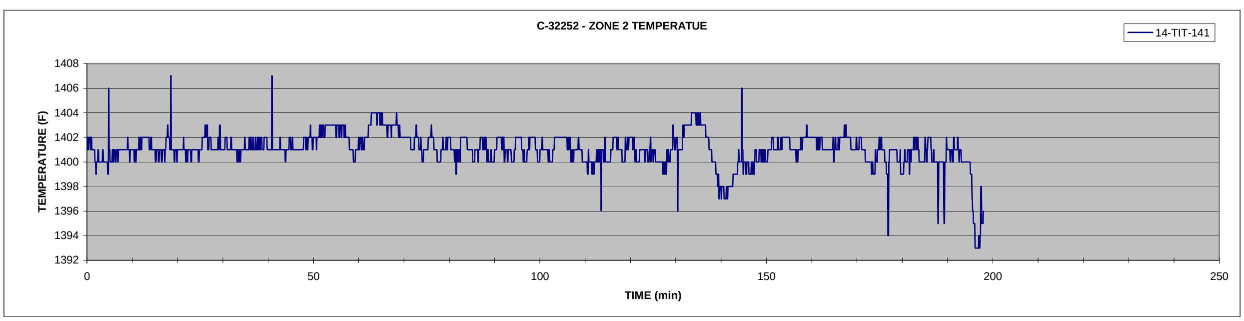


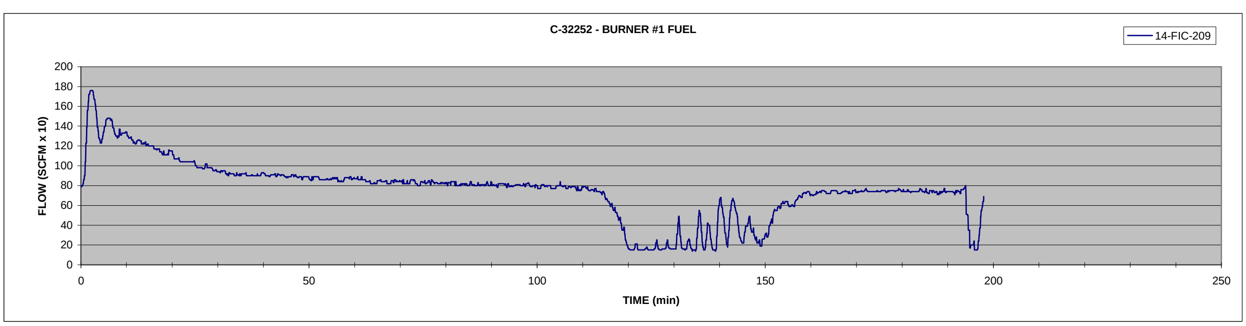
Appendix F – Child TC MPF Test # 11 (page 2 of 3)



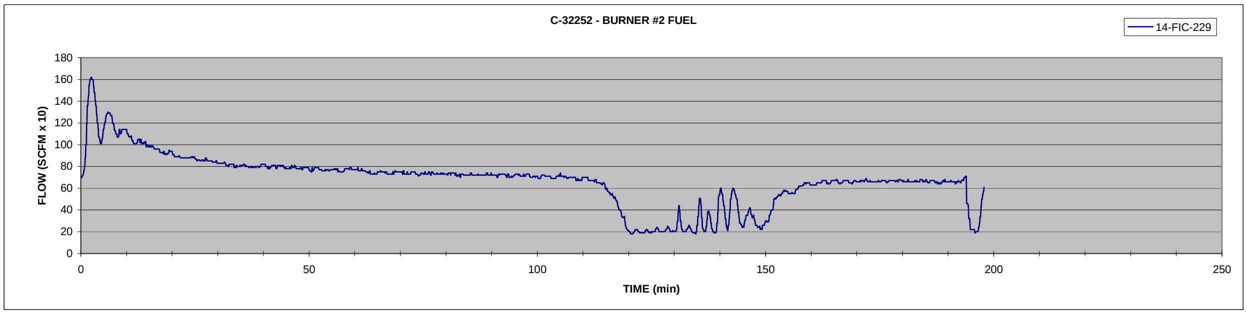


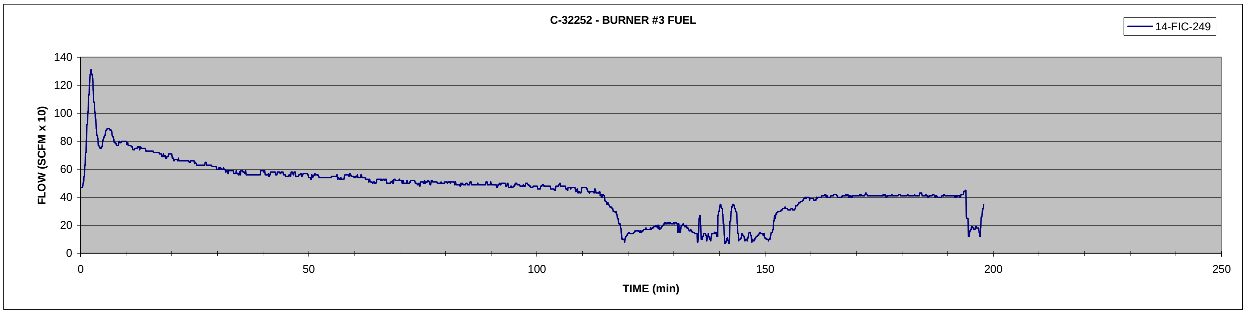


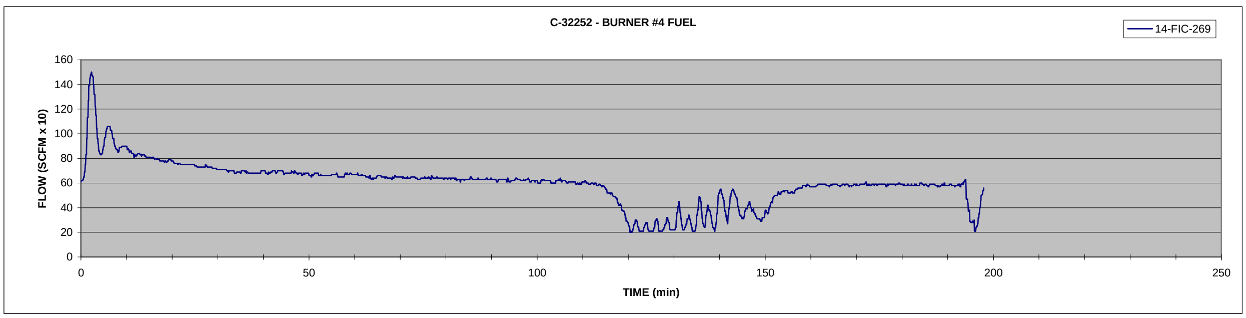


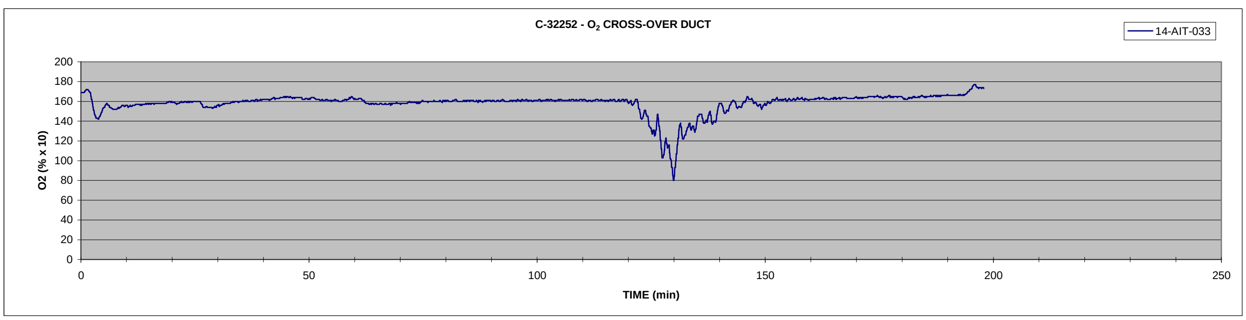


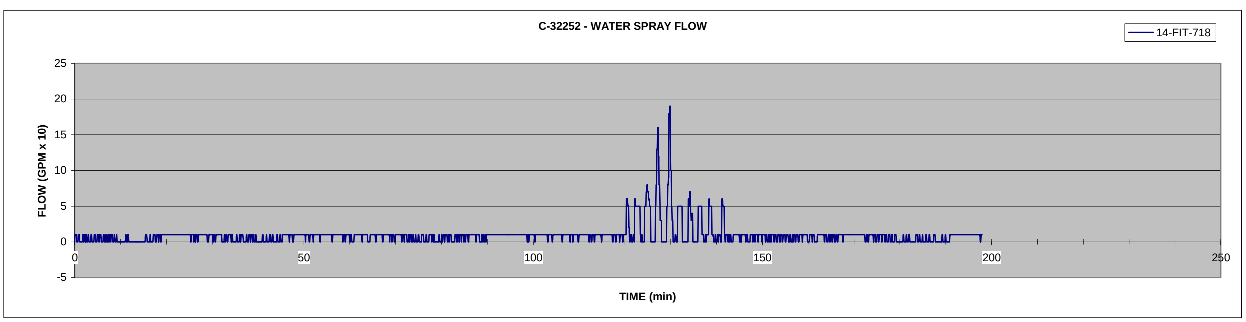
Appendix F – Child TC MPF Test # 11 (page 3 of 3)

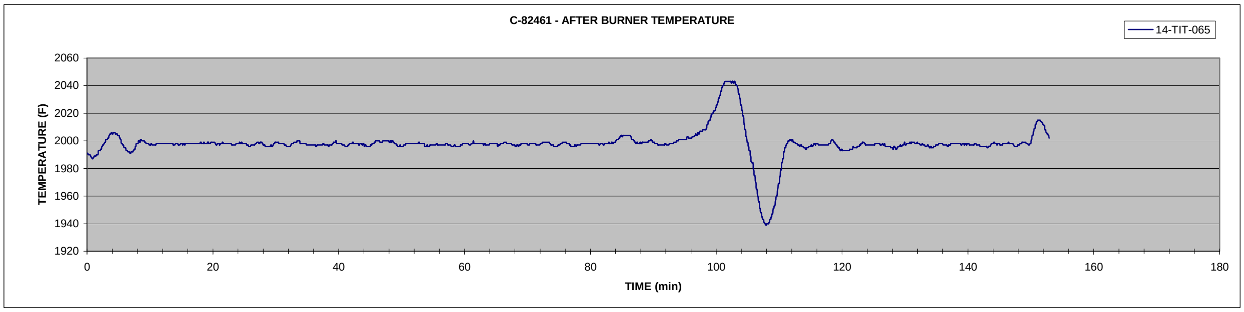


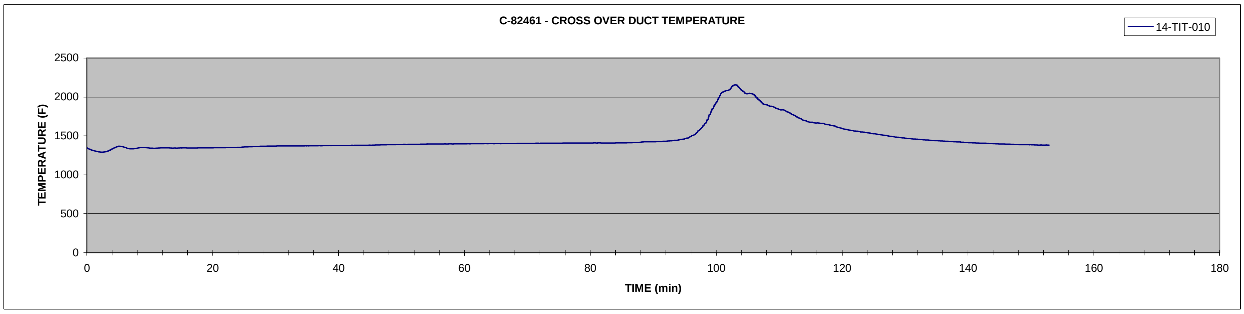


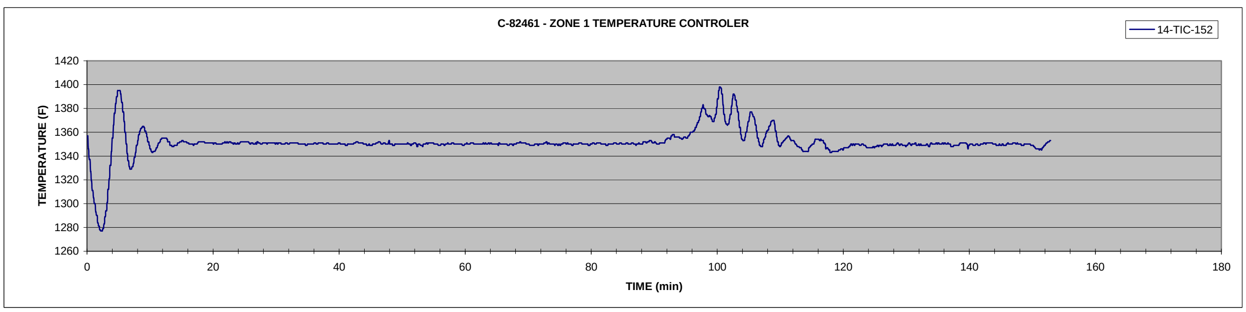


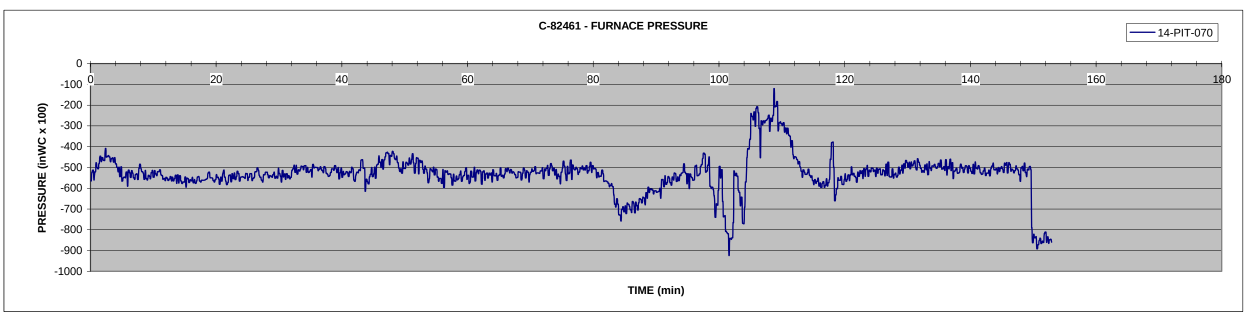


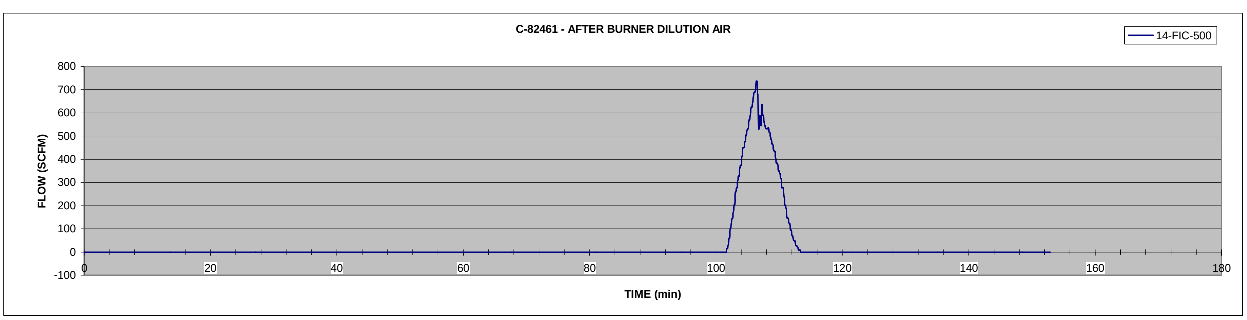



C-82461 - AFTER BURNER TEMPERATURE
14-TIT-065
TEMPERATURE (F)
2060
2040
2020
2000
1980
1960
1940
1920
0
20
40
60
80
100
120
140
160
180
TIME (min)

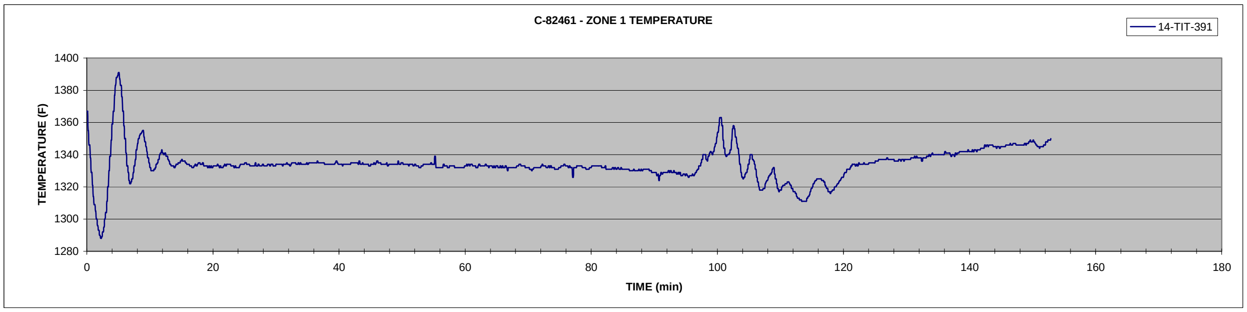

C-82461 - CROSS OVER DUCT TEMPERATURE
14-TIT-010
TEMPERATURE (F)
2500
2000
1500
1000
500
0
0
20
40
60
80
100
120
140
160
180
TIME (min)

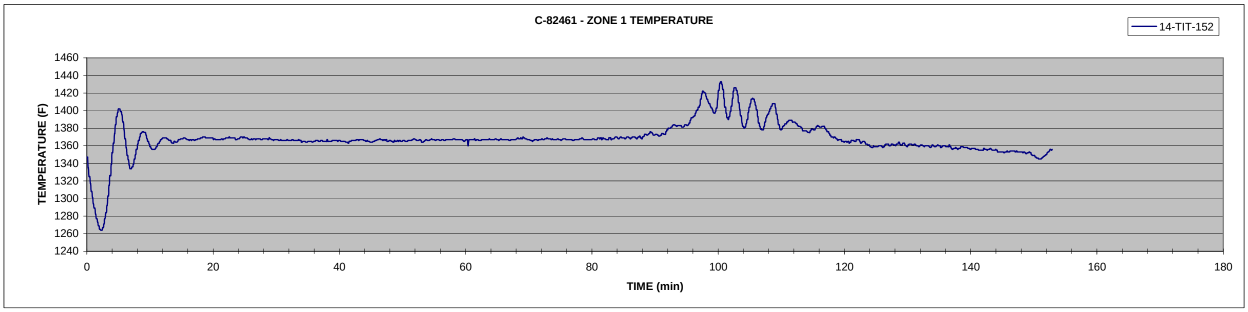

C-82461 - ZONE 1 TEMPERATURE CONTROLER
14-TIC-152
TEMPERATURE (F)
1420
1400
1380
1360
1340
1320
1300
1280
1260
0
20
40
60
80
100
120
140
160
180
TIME (min)

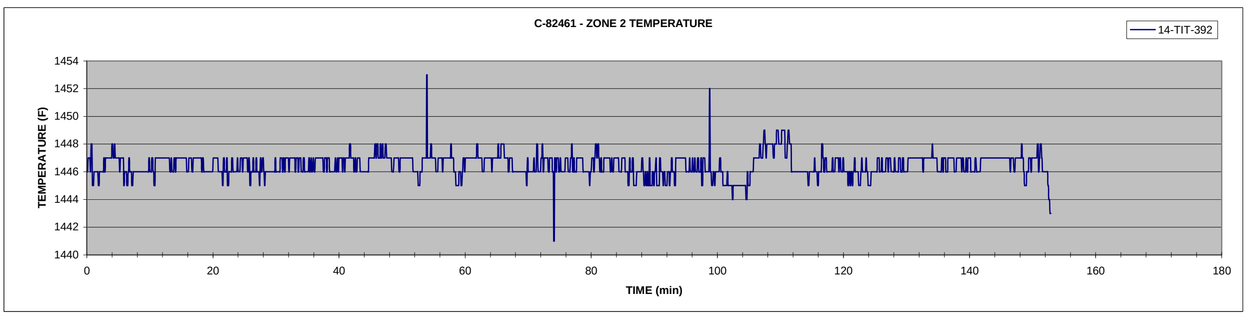

C-82461 - FURNACE PRESSURE
14-PIT-070
PRESSURE (inWC x 100)
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
-1000
0
20
40
60
80
100
120
140
160
180
TIME (min)

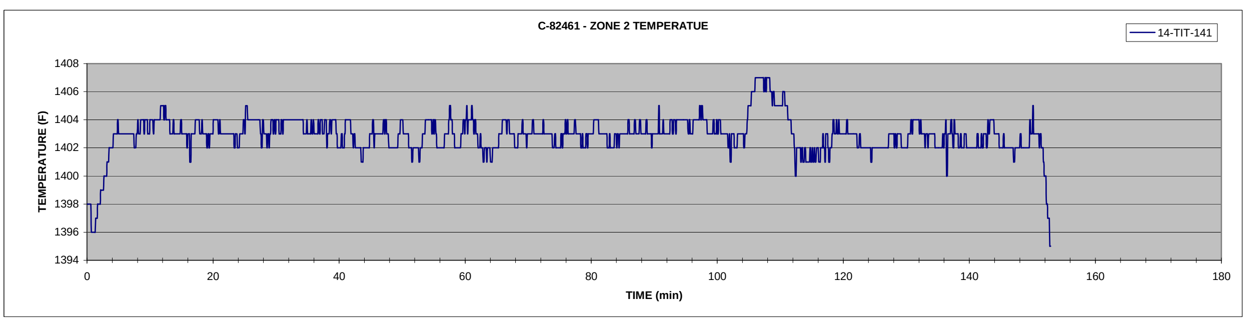

C-82461 - AFTER BURNER DILUTION AIR
14-FIC-500
FLOW (SCFM)
800
700
600
500
400
300
200
100
0
-100
0
20
40
60
80
100
120
140
160
180
TIME (min)

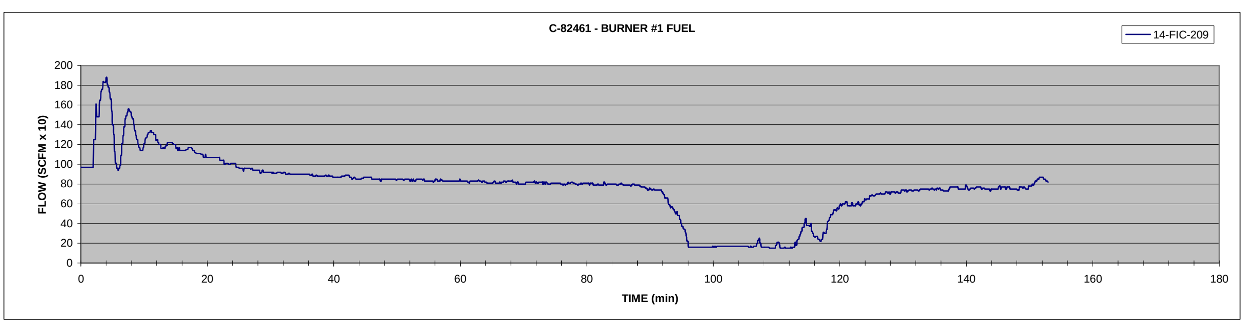
Appendix F – Child TC MPF Test # 12 (page 2 of 3)

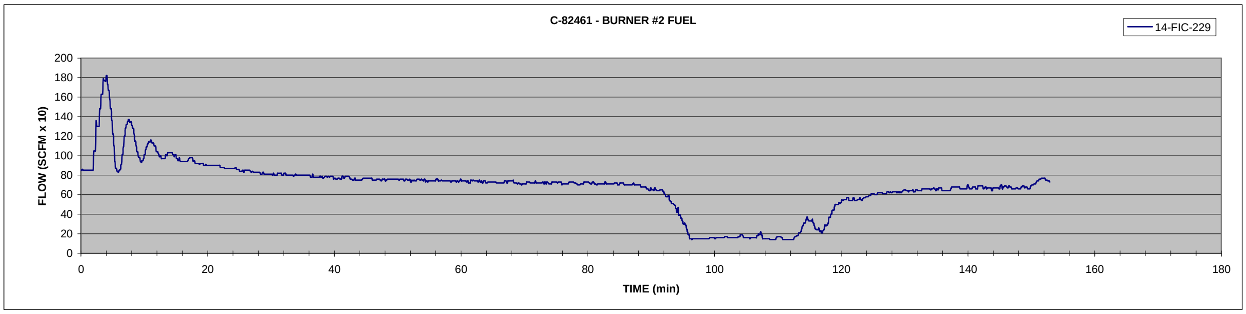


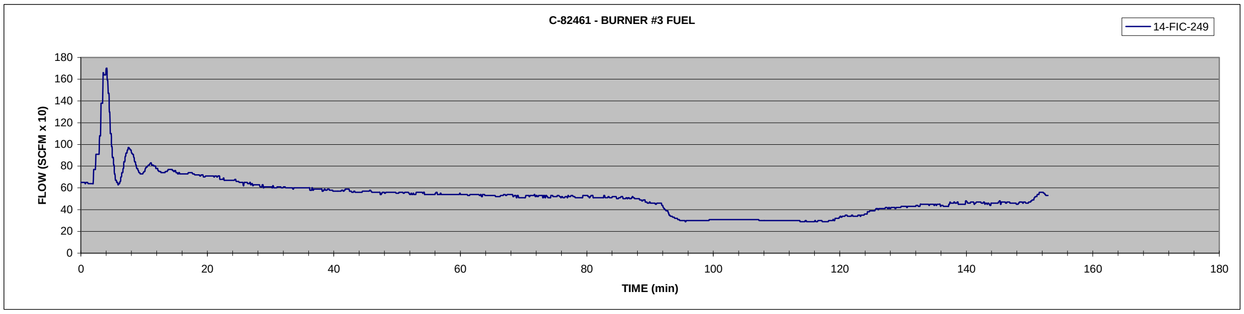


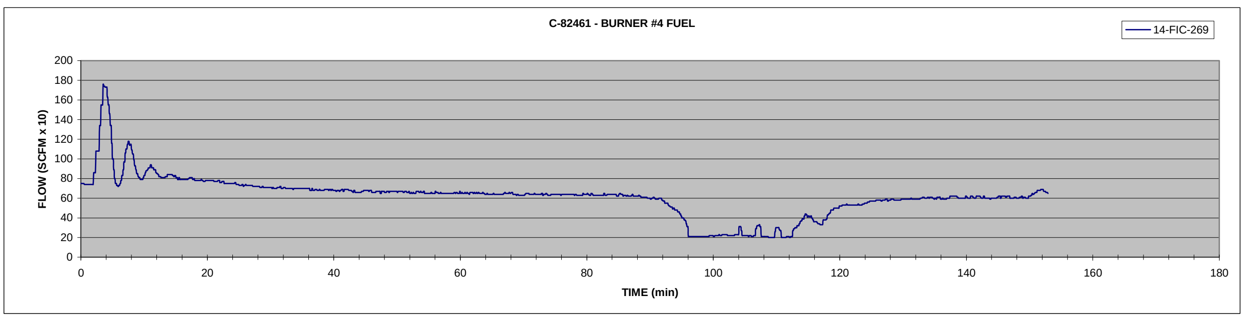


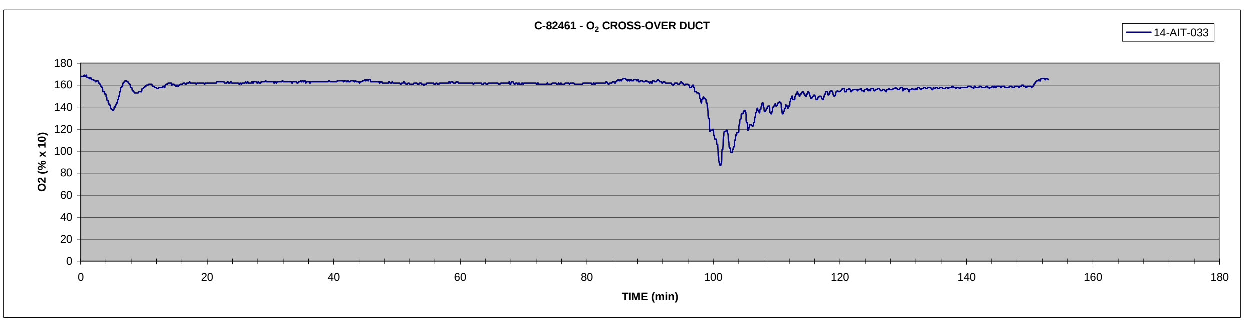


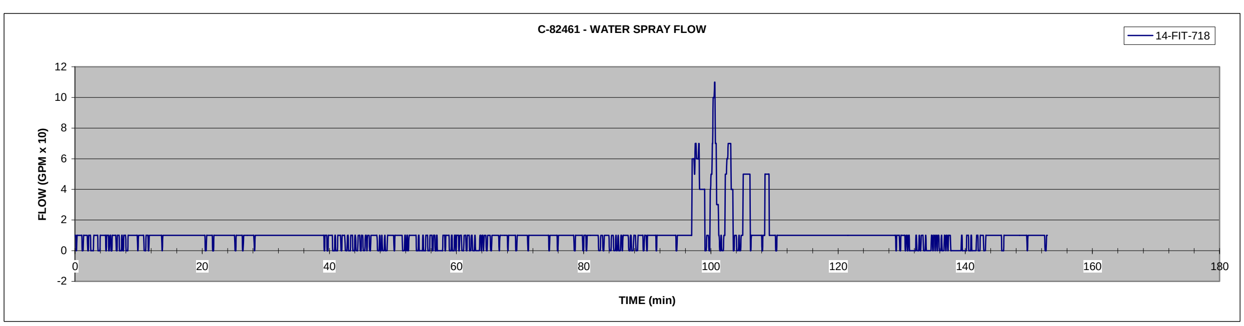



C-82461 - BURNER #2 FUEL
14-FIC-229
FLOW (SCFM x 10)
TIME (min)

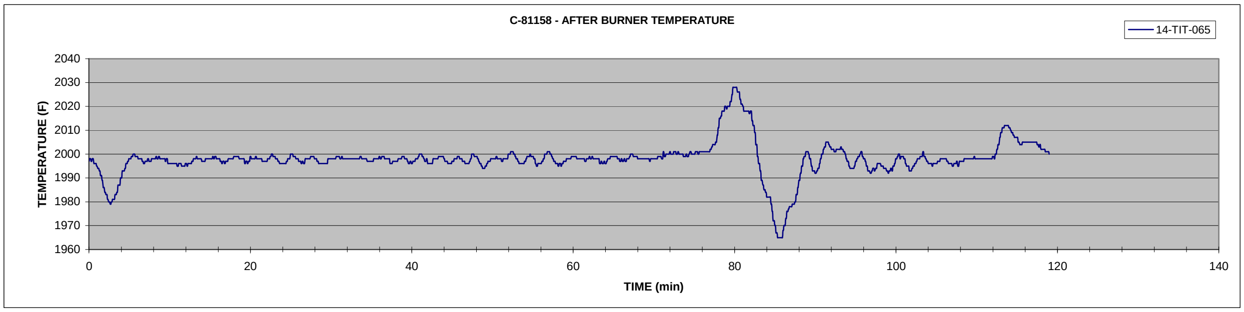

C-82461 - BURNER #3 FUEL
14-FIC-249
FLOW (SCFM x 10)
TIME (min)

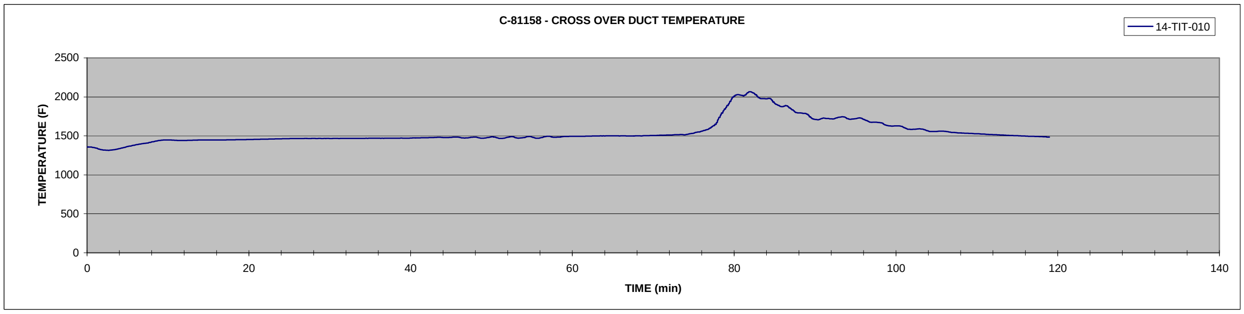

C-82461 - BURNER #4 FUEL
14-FIC-269
FLOW (SCFM x 10)
TIME (min)

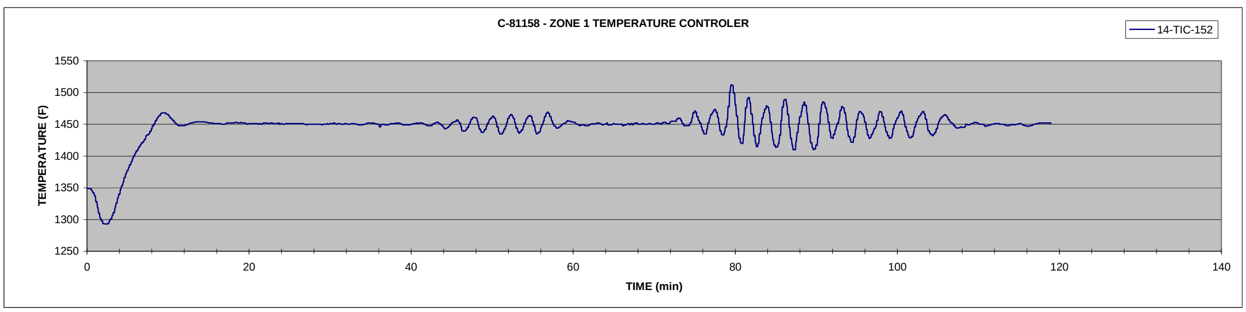

C-82461 - O2 CROSS-OVER DUCT
14-AIT-033
O2 (% x 10)
TIME (min)

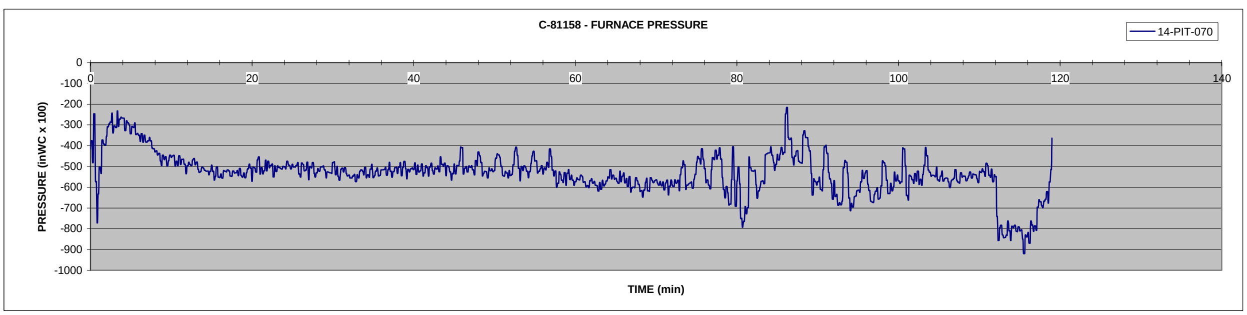

C-82461 - WATER SPRAY FLOW
14-FIT-718
FLOW (GPM x 10)
TIME (min)

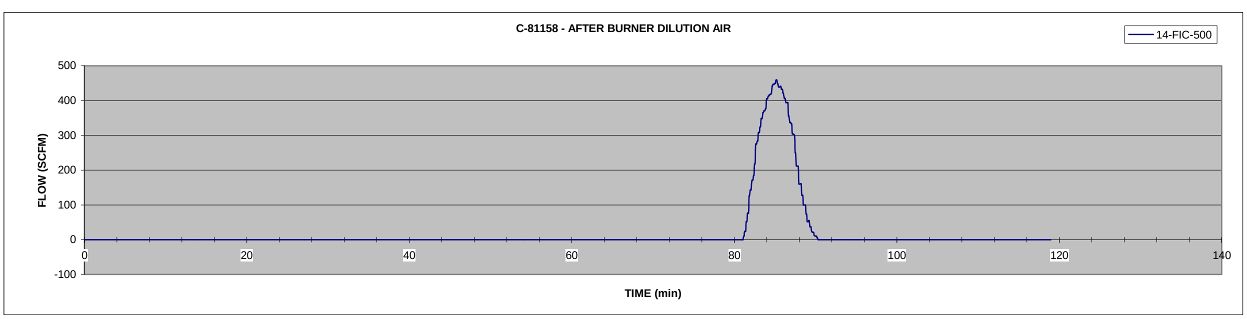
Appendix F – Child TC MPF Test # 13 (page 1 of 3)



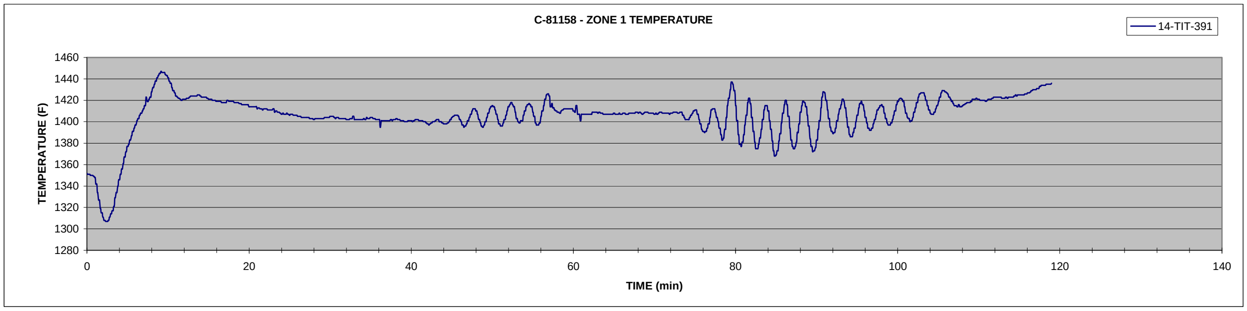


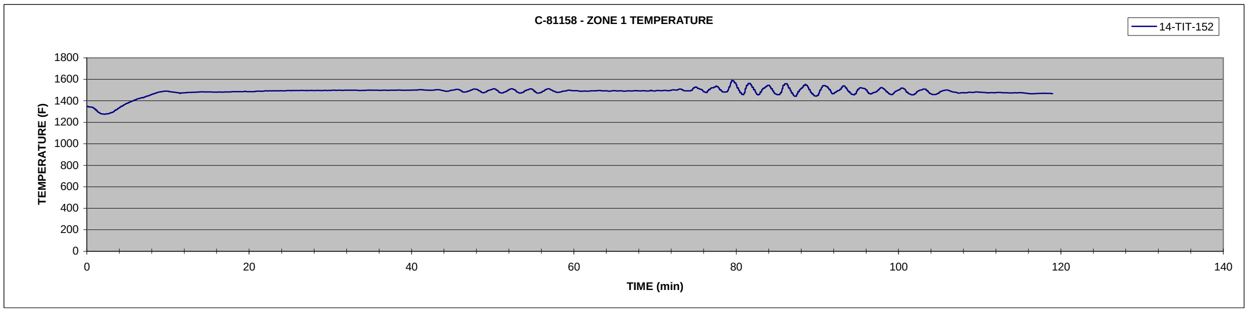


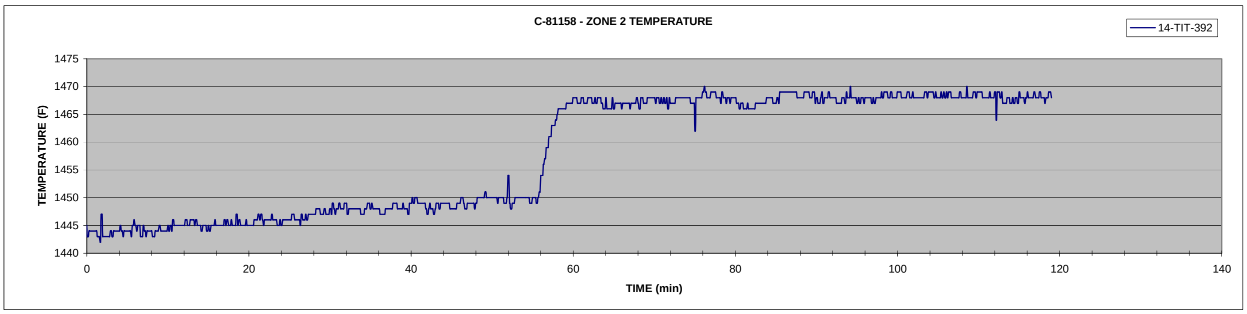


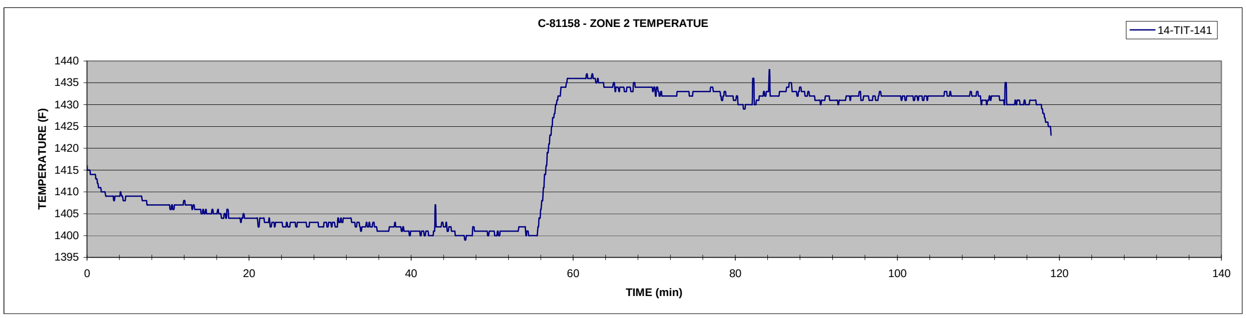


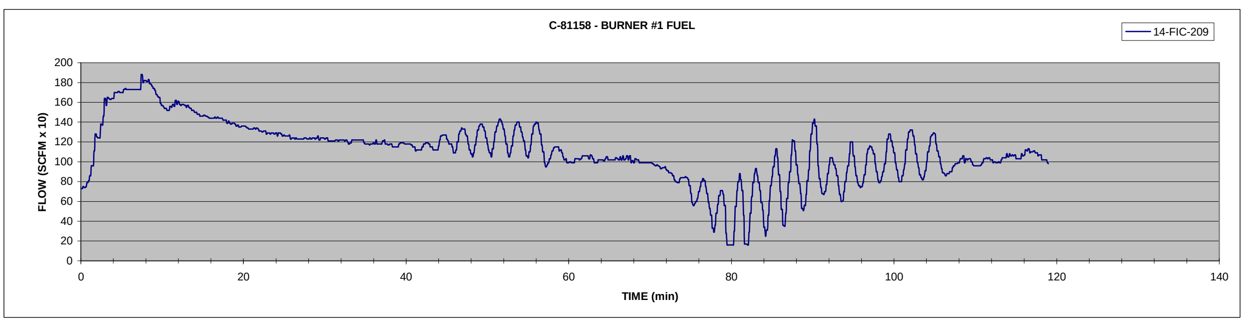
Appendix F – Child TC MPF Test # 13 (page 2 of 3)



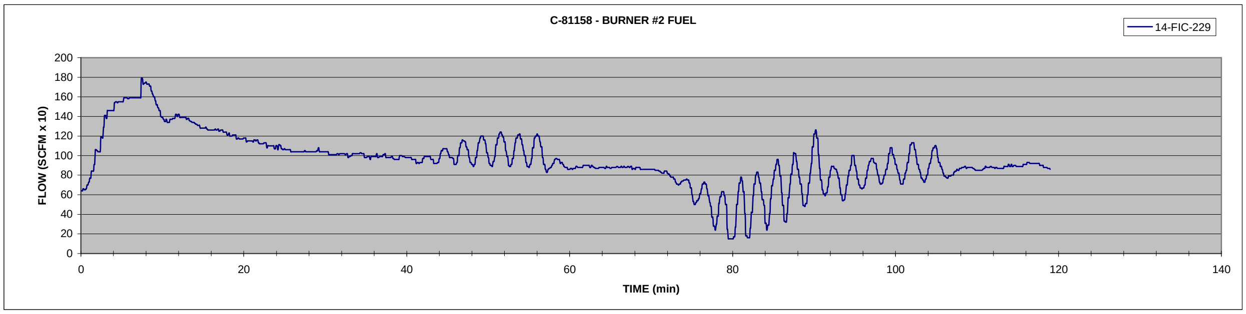


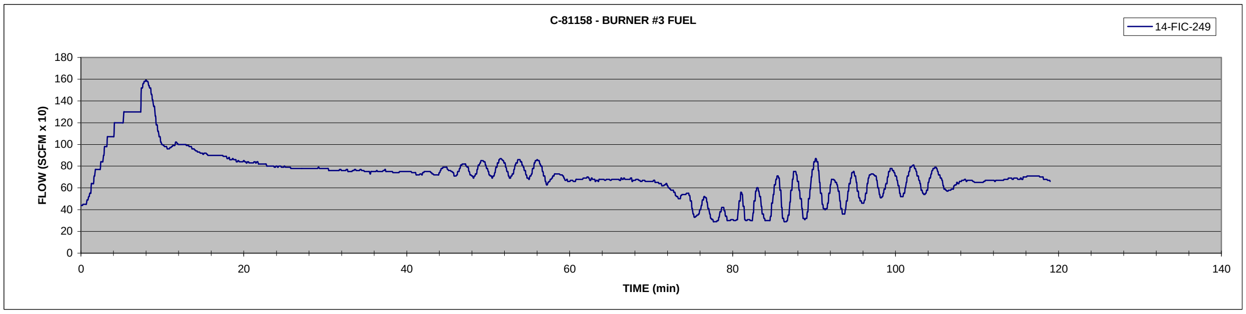


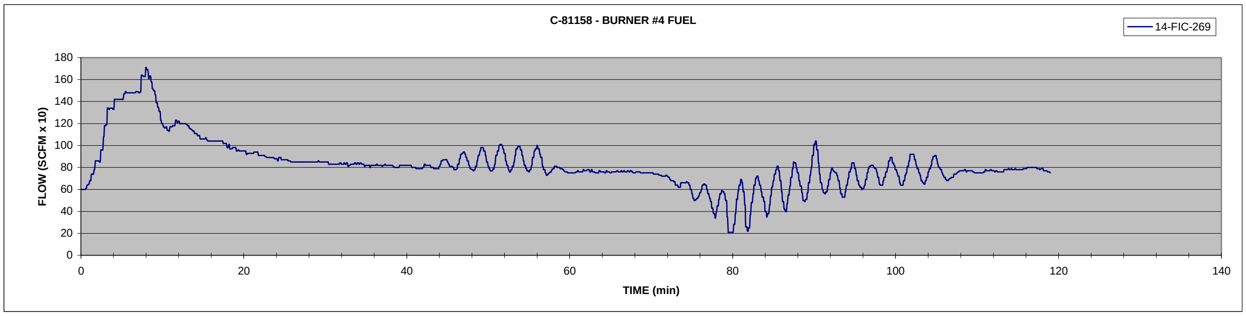


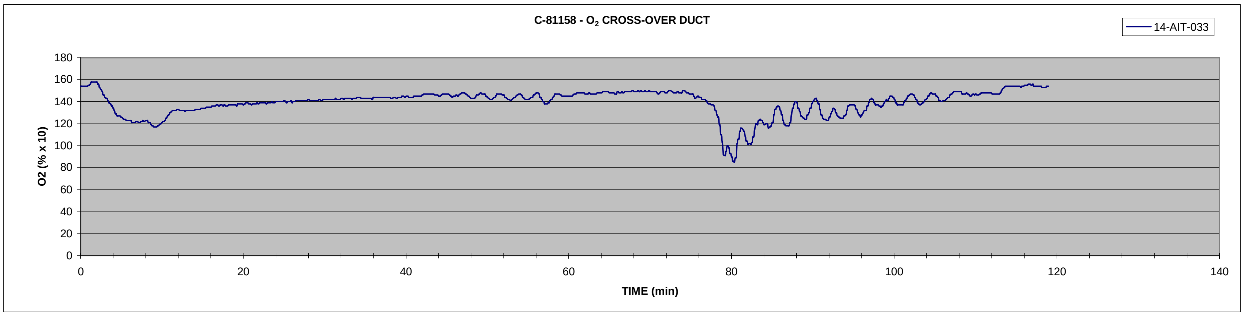


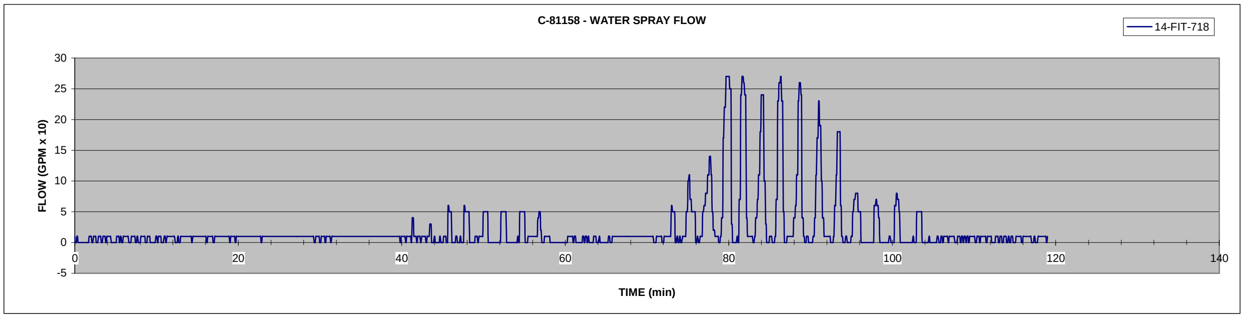
Appendix F – Child TC MPF Test # 13 (page 3 of 3)



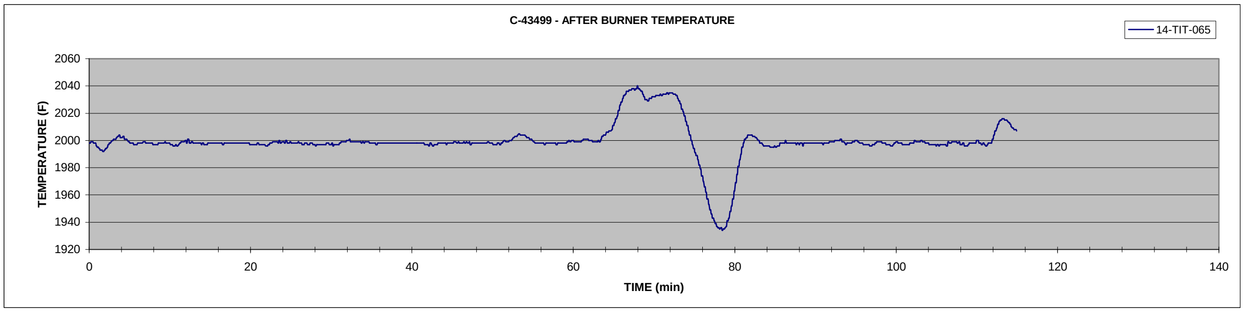


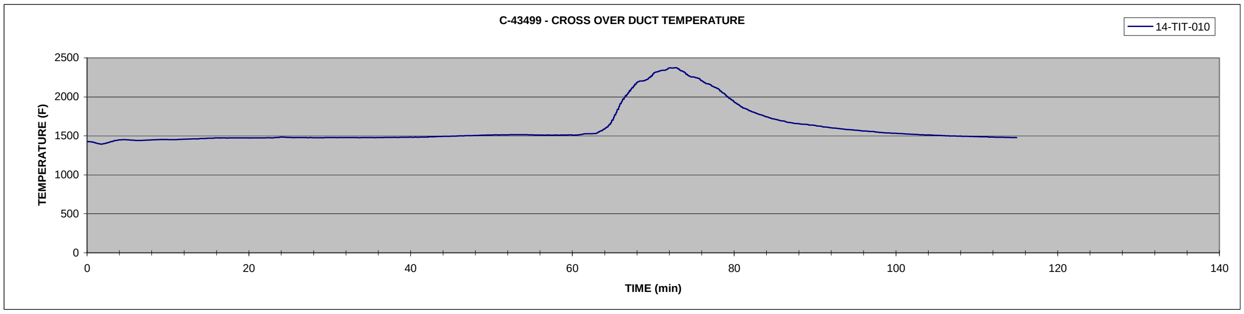


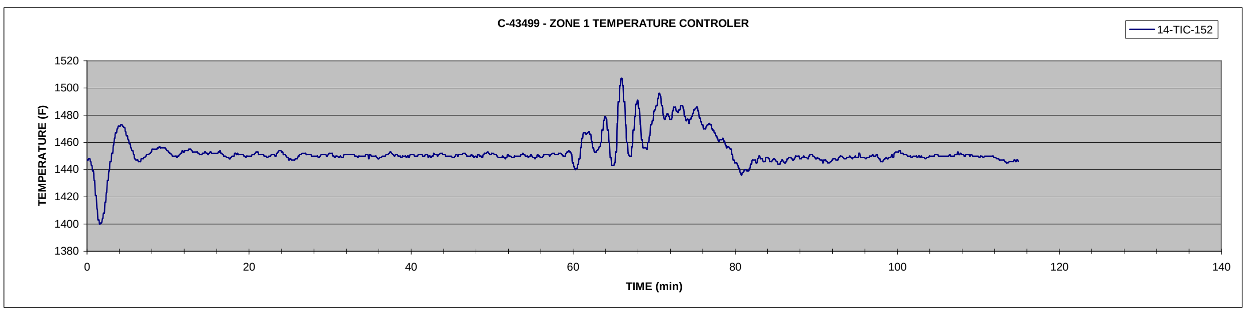


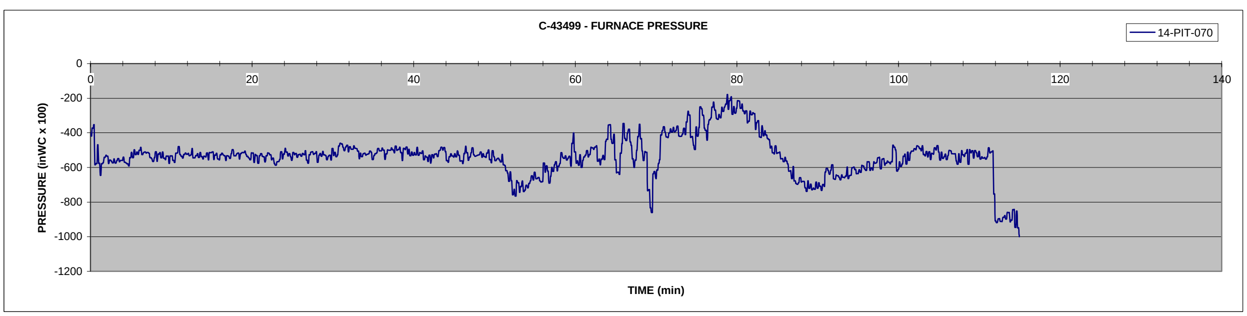


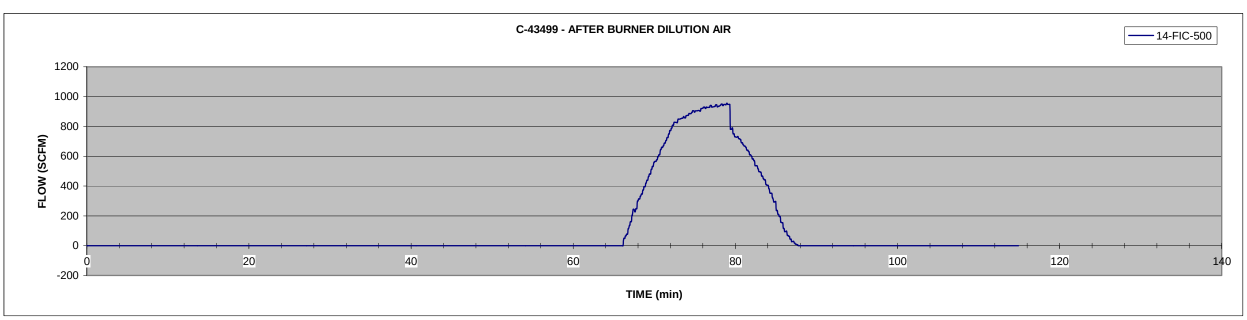
Appendix F – Child TC MPF Test # 14 (page 1 of 3)

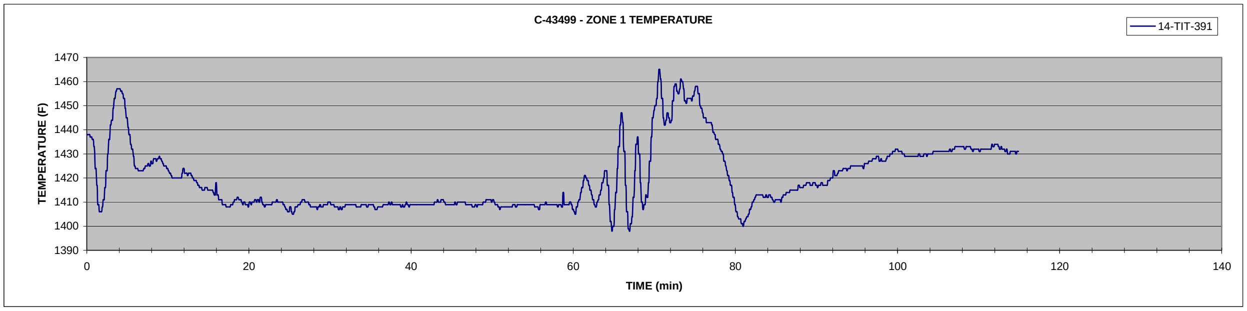


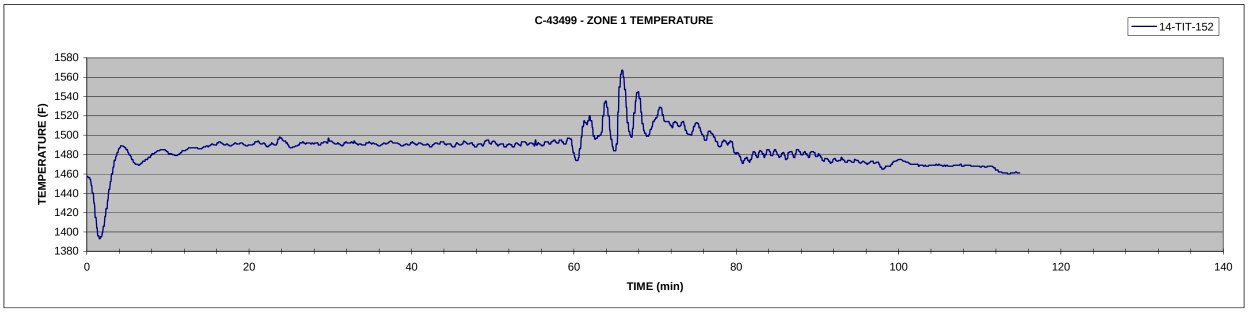


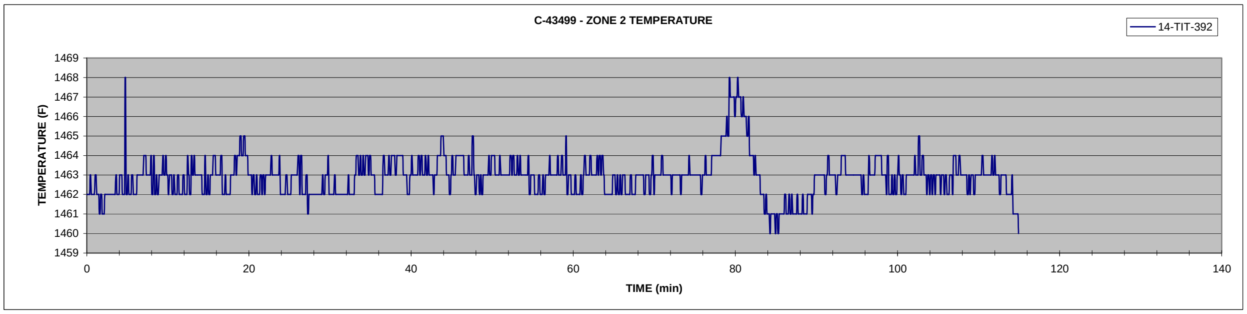


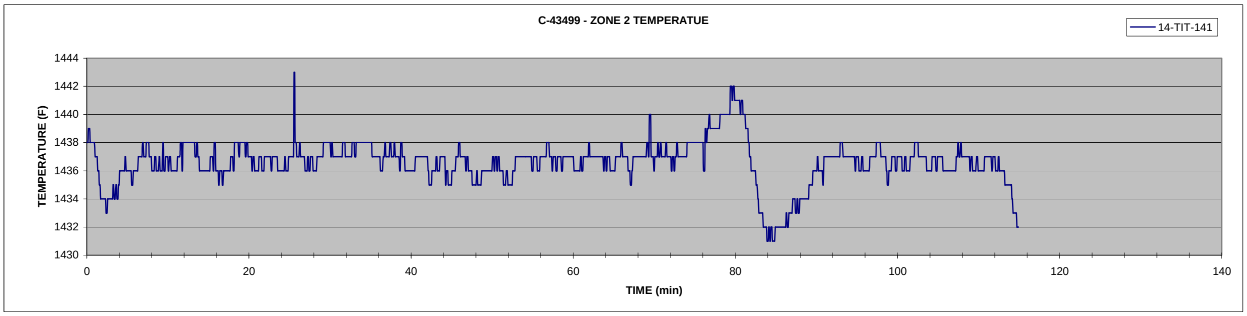


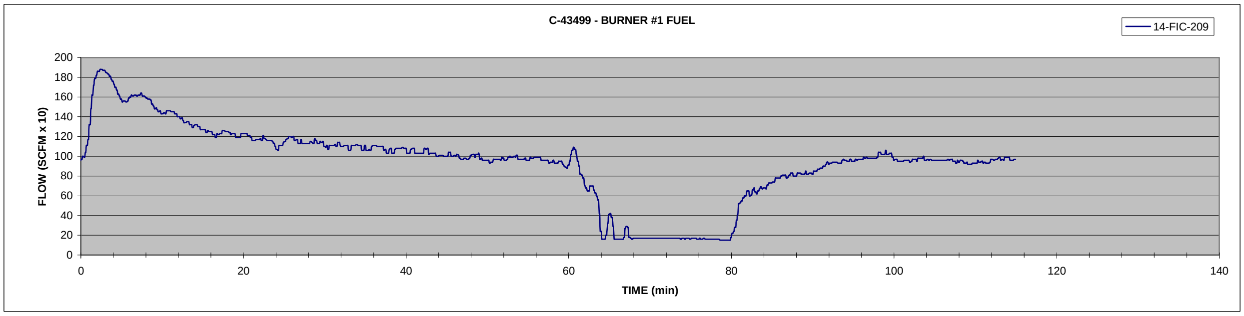


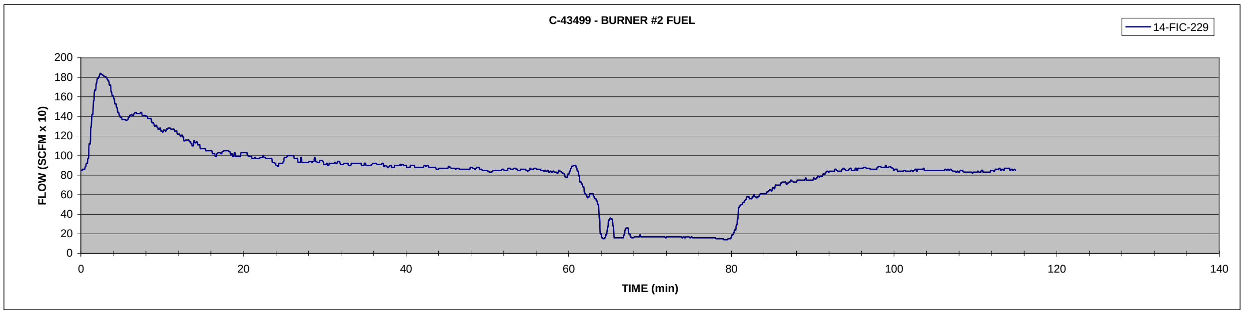

C-43499 - ZONE 1 TEMPERATURE
14-TIT-391
TEMPERATURE (F)
1470
1460
1450
1440
1430
1420
1410
1400
1390
0
20
40
60
80
100
120
140
TIME (min)

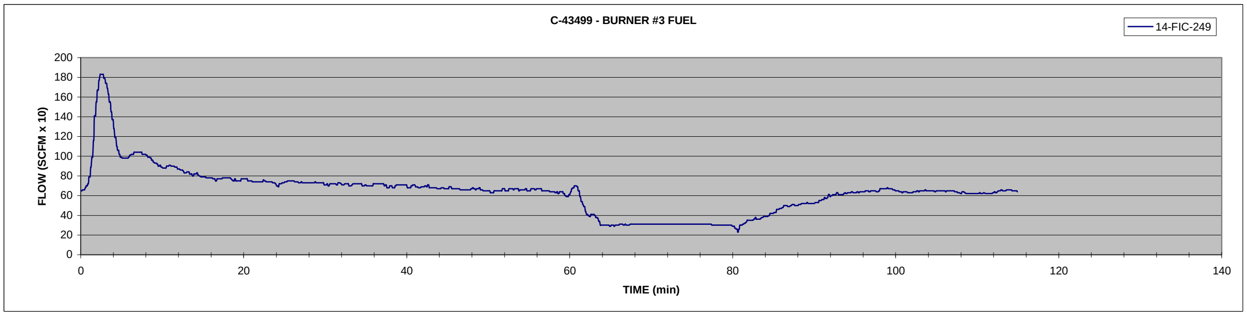

C-43499 - ZONE 1 TEMPERATURE
14-TIT-152
TEMPERATURE (F)
1580
1560
1540
1520
1500
1480
1460
1440
1420
1400
1380
0
20
40
60
80
100
120
140
TIME (min)

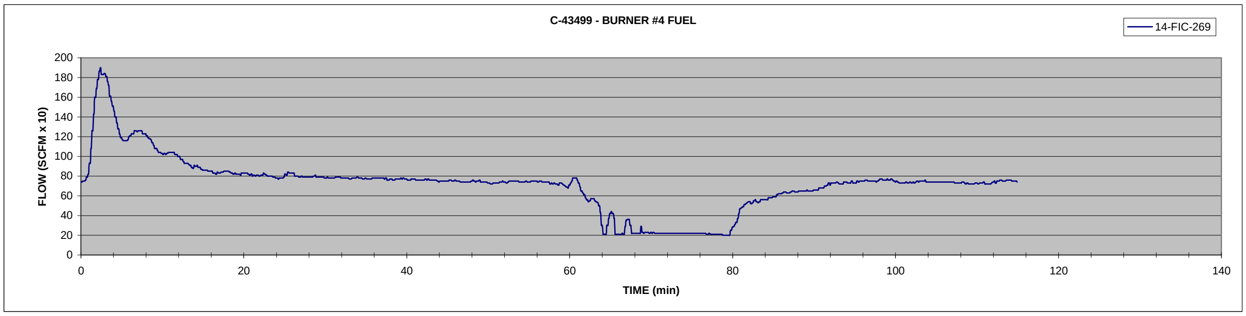

C-43499 - ZONE 2 TEMPERATURE
14-TIT-392
TEMPERATURE (F)
1469
1468
1467
1466
1465
1464
1463
1462
1461
1460
1459
0
20
40
60
80
100
120
140
TIME (min)

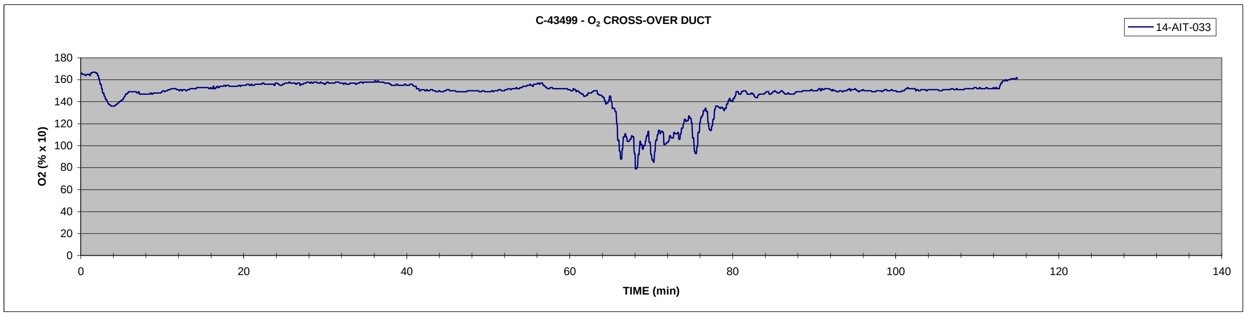

C-43499 - ZONE 2 TEMPERATUE
14-TIT-141
TEMPERATURE (F)
1444
1442
1440
1438
1436
1434
1432
1430
0
20
40
60
80
100
120
140
TIME (min)

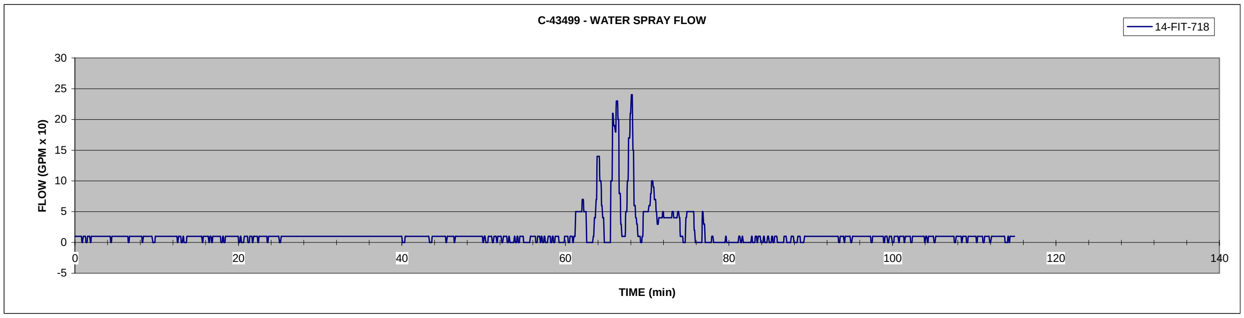

C-43499 - BURNER #1 FUEL
14-FIC-209
FLOW (SCFM x 10)
200
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
TIME (min)


C-43499 - BURNER #2 FUEL
14-FIC-229
FLOW (SCFM x 10)
TIME (min)
0
20
40
60
80
100
120
140
160
180
200
0
20
40
60
80
100
120
140

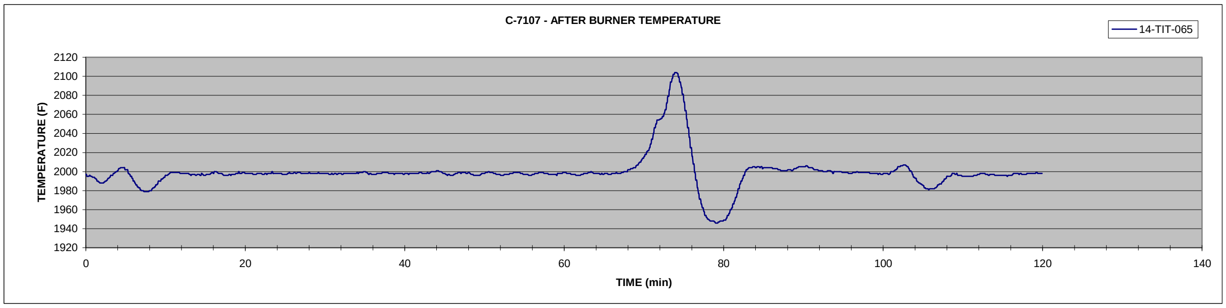

C-43499 - BURNER #3 FUEL
14-FIC-249
FLOW (SCFM x 10)
TIME (min)
0
20
40
60
80
100
120
140
160
180
200
0
20
40
60
80
100
120
140

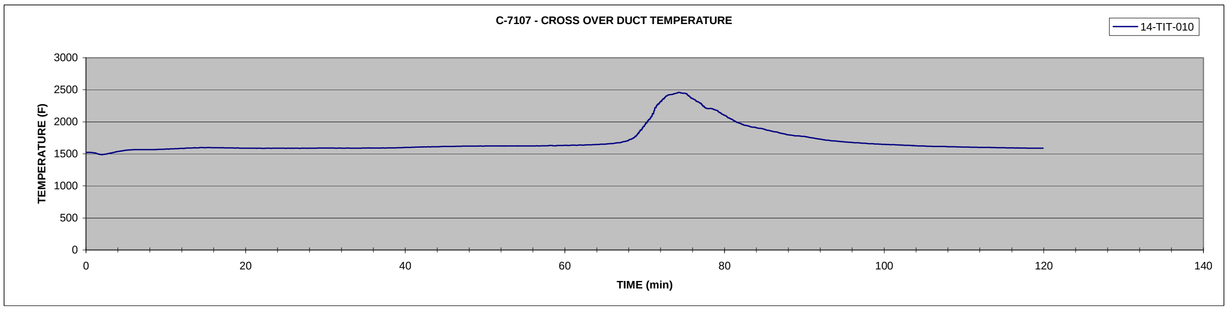

C-43499 - BURNER #4 FUEL
14-FIC-269
FLOW (SCFM x 10)
TIME (min)
0
20
40
60
80
100
120
140
160
180
200
0
20
40
60
80
100
120
140

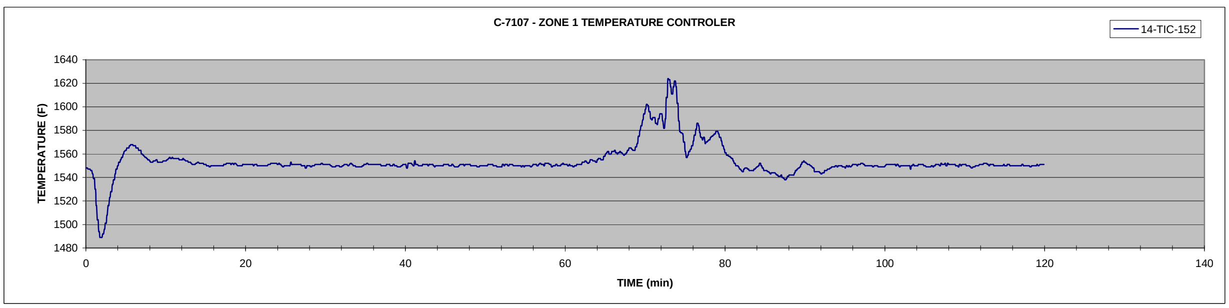

C-43499 - O_2 CROSS-OVER DUCT
14-AIT-033
O2 (% x 10)
TIME (min)
0
20
40
60
80
100
120
140
160
180
0
20
40
60
80
100
120
140

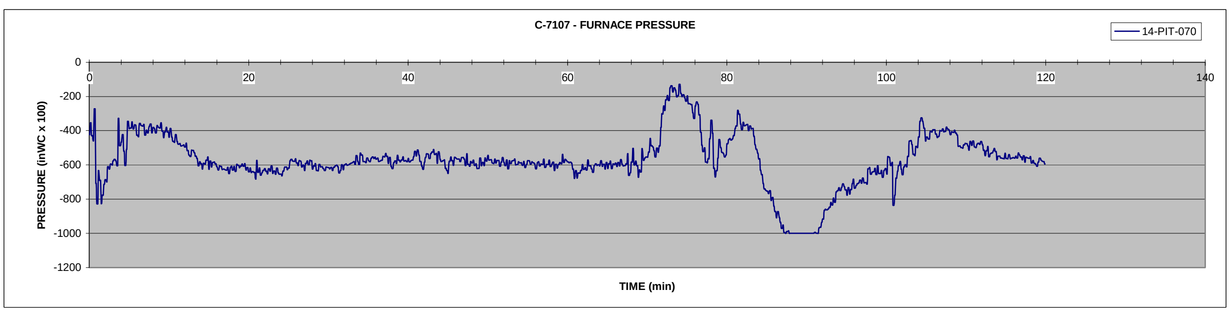

C-43499 - WATER SPRAY FLOW
14-FIT-718
FLOW (GPM x 10)
TIME (min)
-5
0
5
10
15
20
25
30
0
20
40
60
80
100
120
140

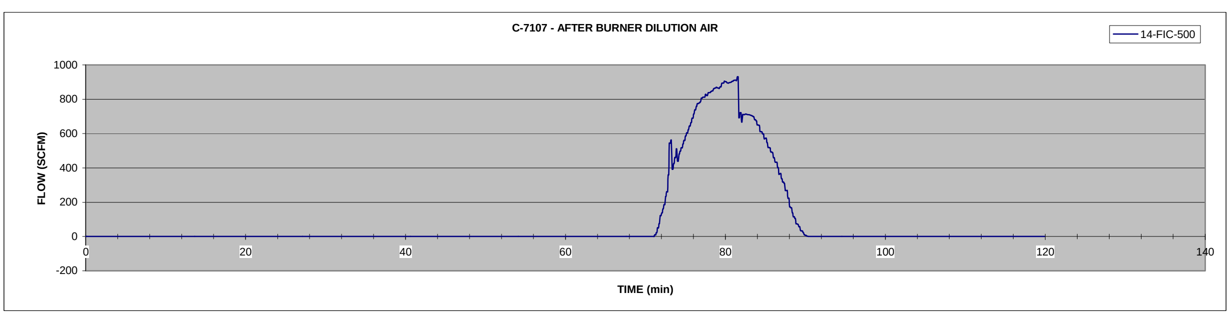
Appendix F – Child TC MPF Test # 15 (page 1 of 3)



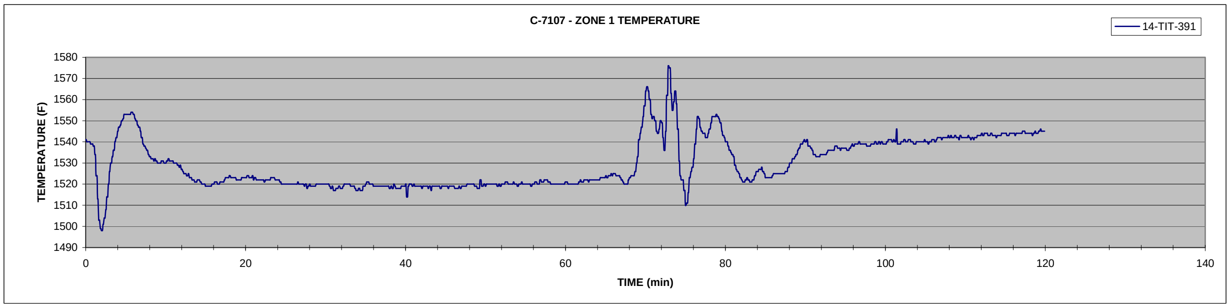


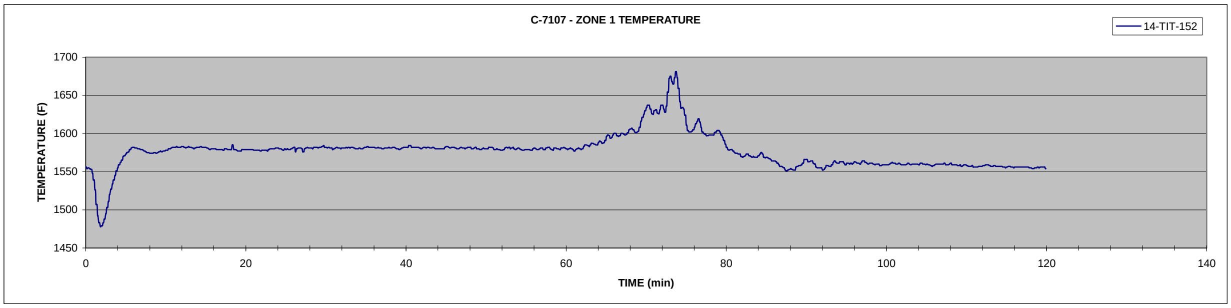


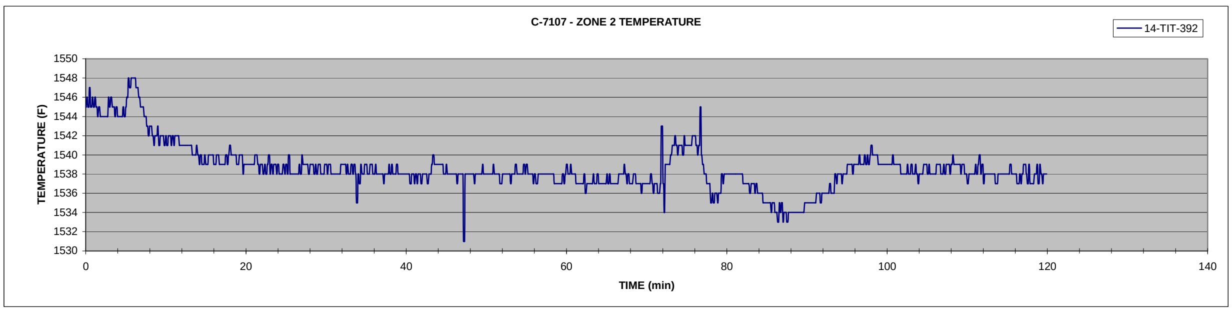


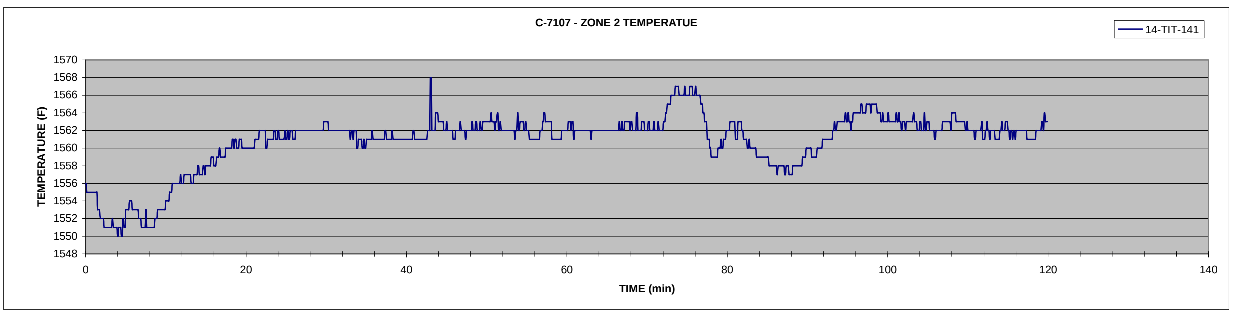


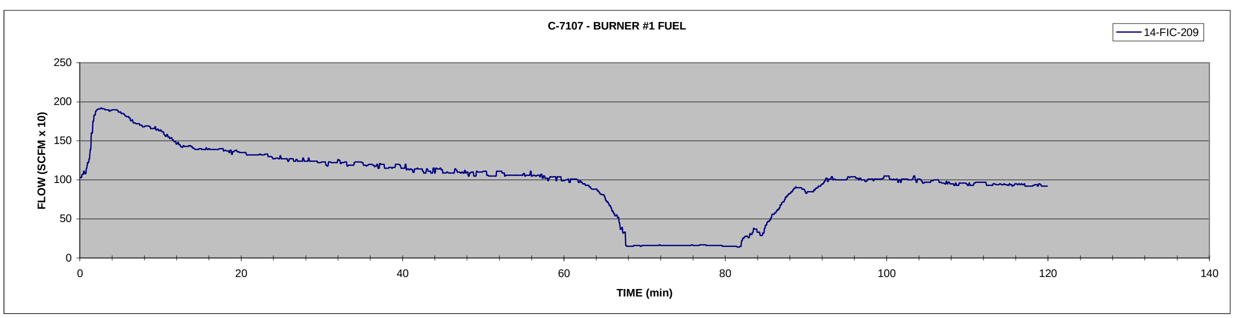
Appendix F – Child TC MPF Test # 15 (page 2 of 3)

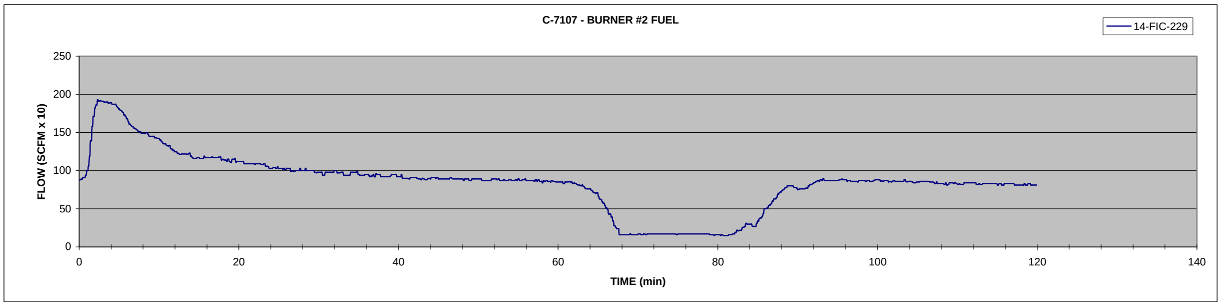


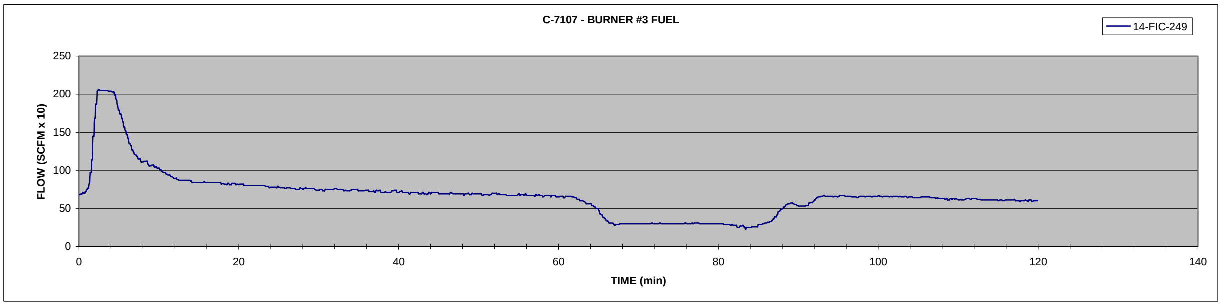


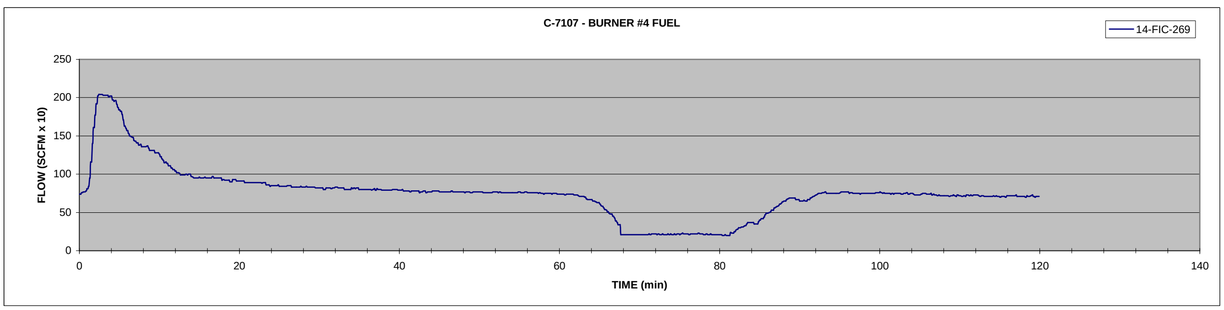


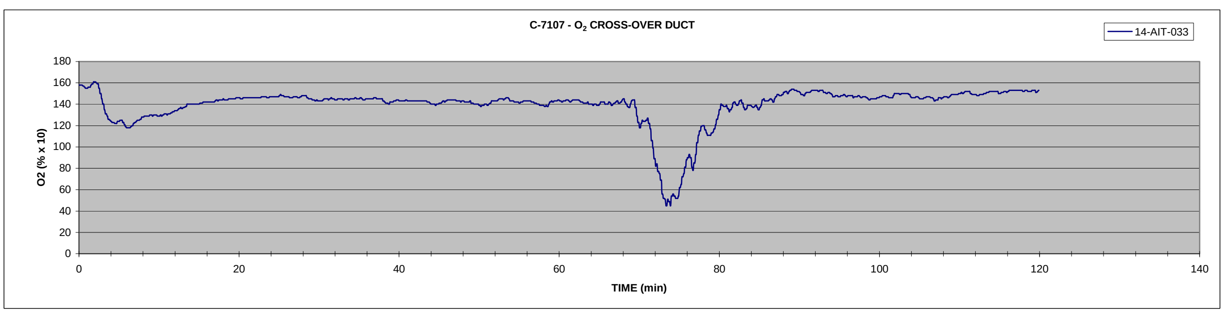


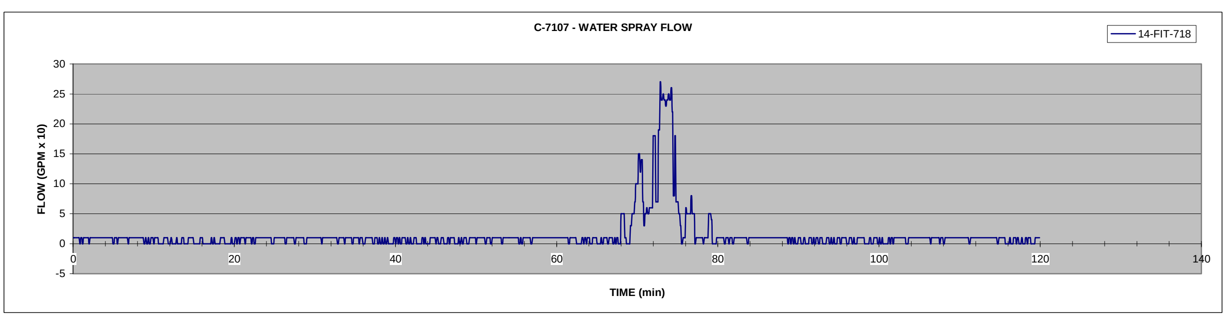



C-7107 - BURNER #2 FUEL
14-FIC-229
FLOW (SCFM x 10)
250
200
150
100
50
0
0
20
40
60
80
100
120
140
TIME (min)

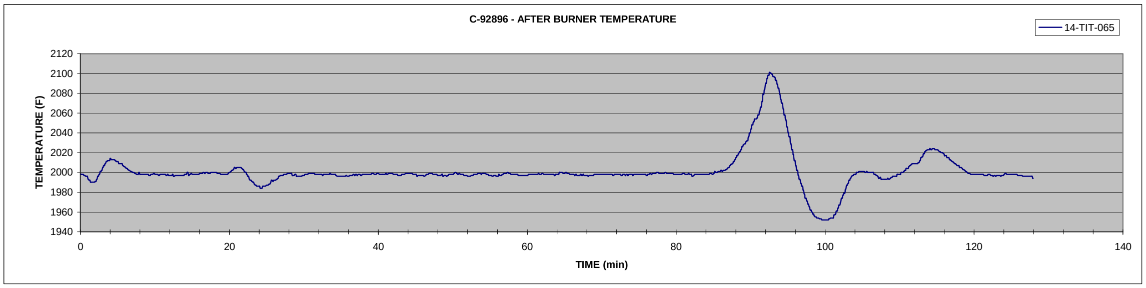

C-7107 - BURNER #3 FUEL
14-FIC-249
FLOW (SCFM x 10)
250
200
150
100
50
0
0
20
40
60
80
100
120
140
TIME (min)

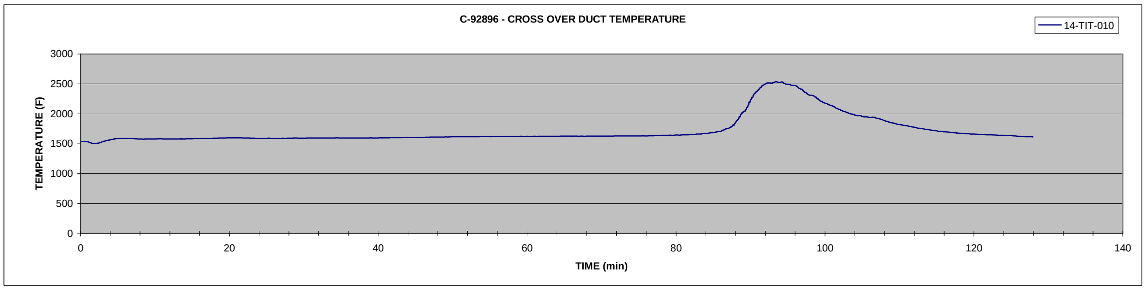

C-7107 - BURNER #4 FUEL
14-FIC-269
FLOW (SCFM x 10)
250
200
150
100
50
0
0
20
40
60
80
100
120
140
TIME (min)

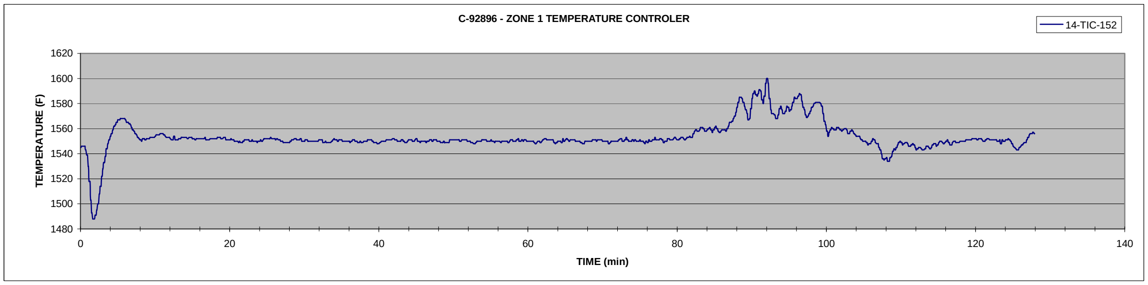

C-7107 - O_2 CROSS-OVER DUCT
14-AIT-033
O2 (% x 10)
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
TIME (min)

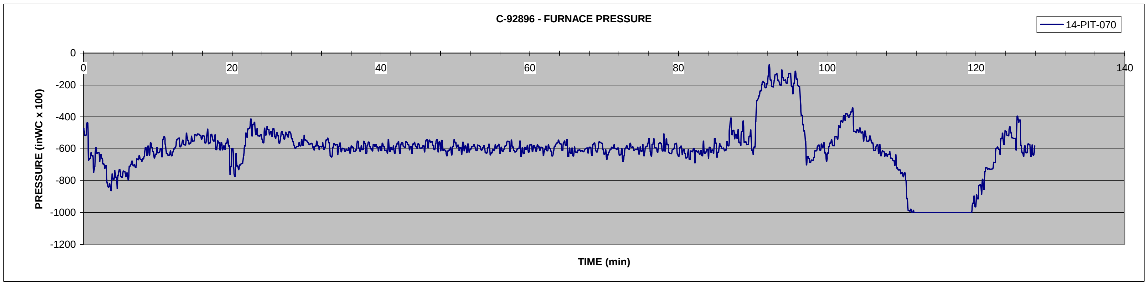

C-7107 - WATER SPRAY FLOW
14-FIT-718
FLOW (GPM x 10)
30
25
20
15
10
5
0
-5
0
20
40
60
80
100
120
140
TIME (min)

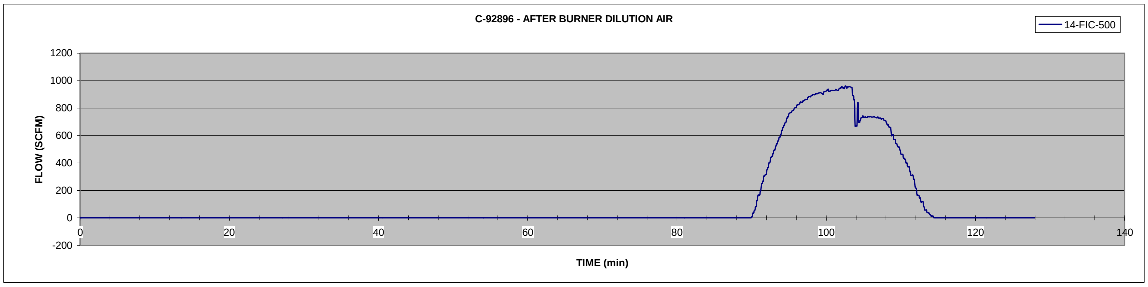
Appendix F – Child TC MPF Test # 16 (page 1 of 3)



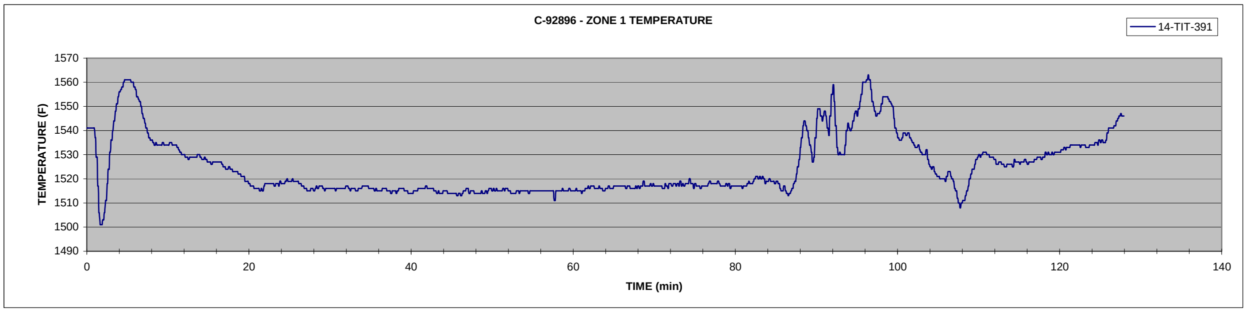


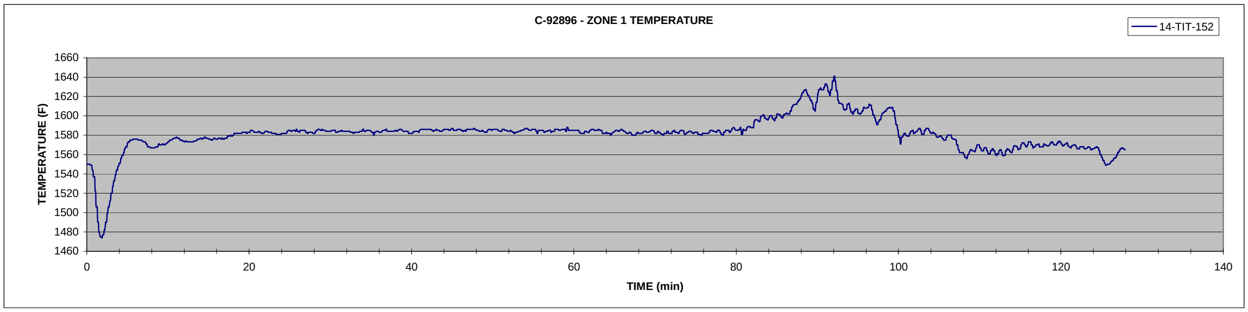


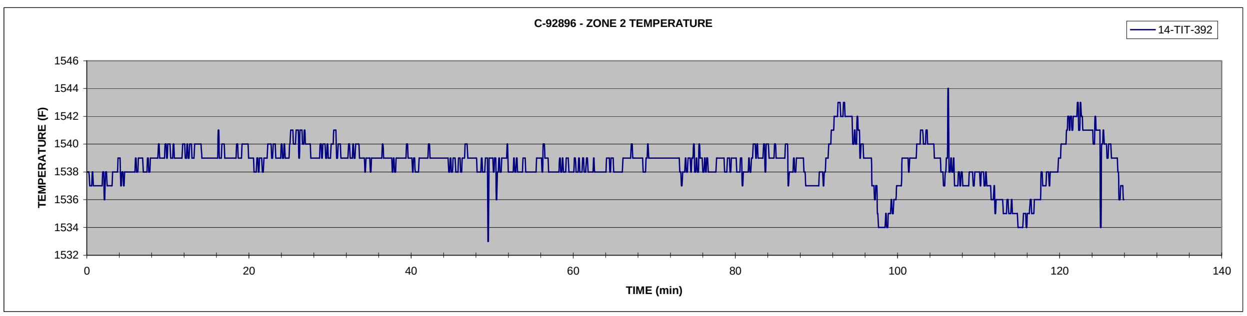


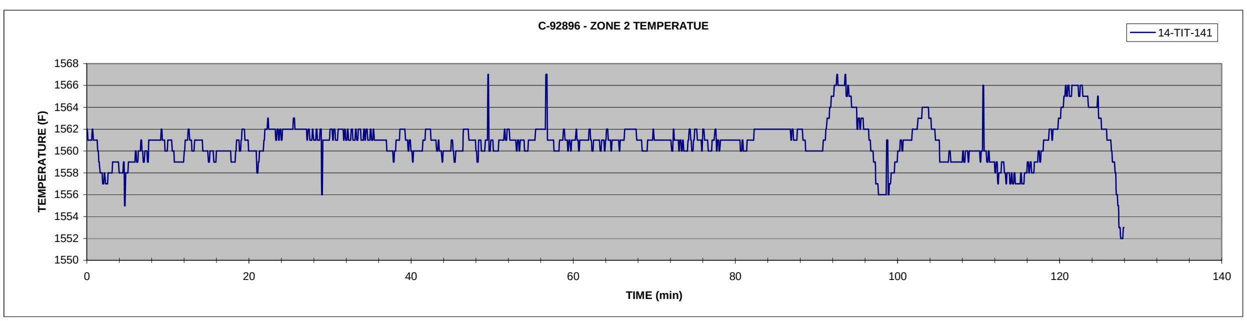


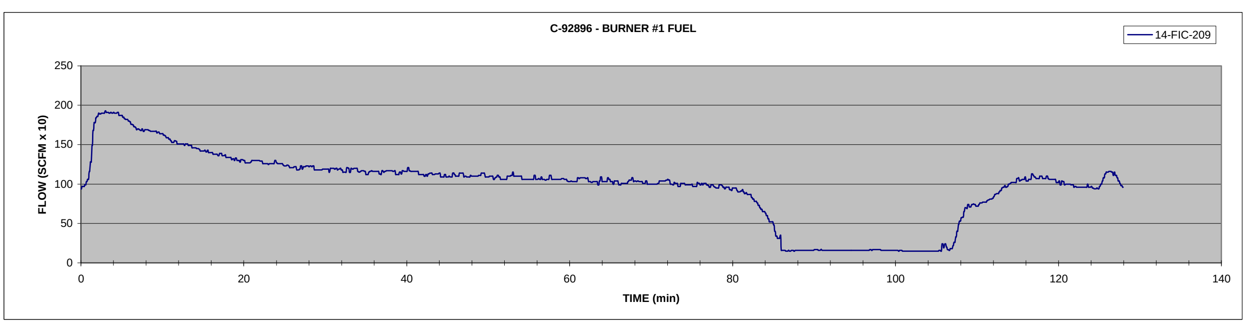
Appendix F – Child TC MPF Test # 16 (page 2 of 3)

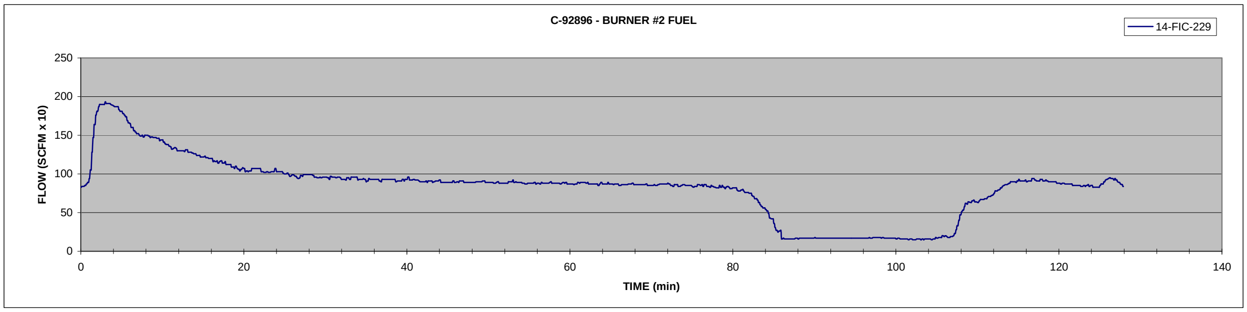


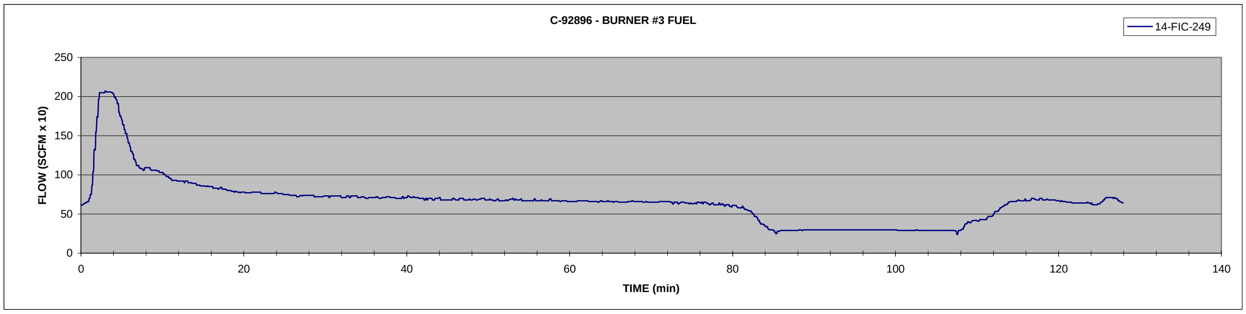


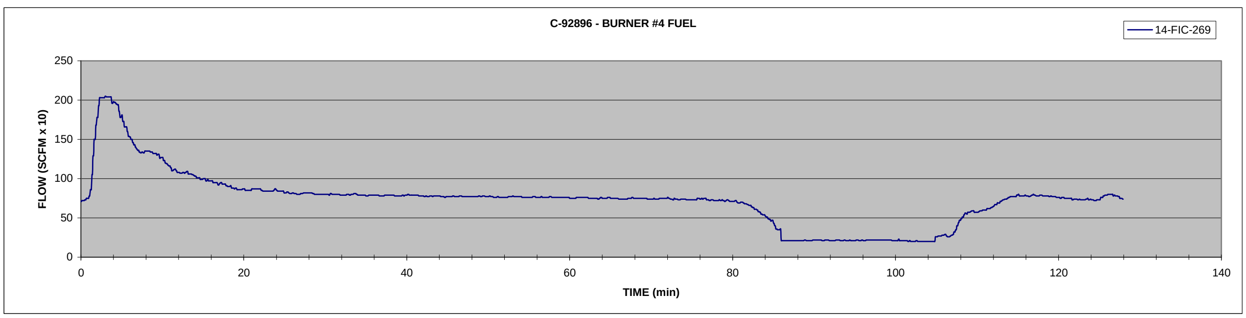


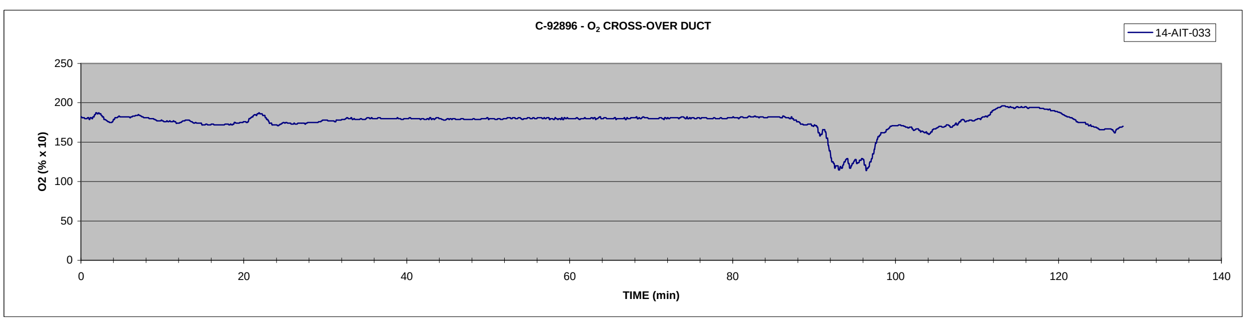


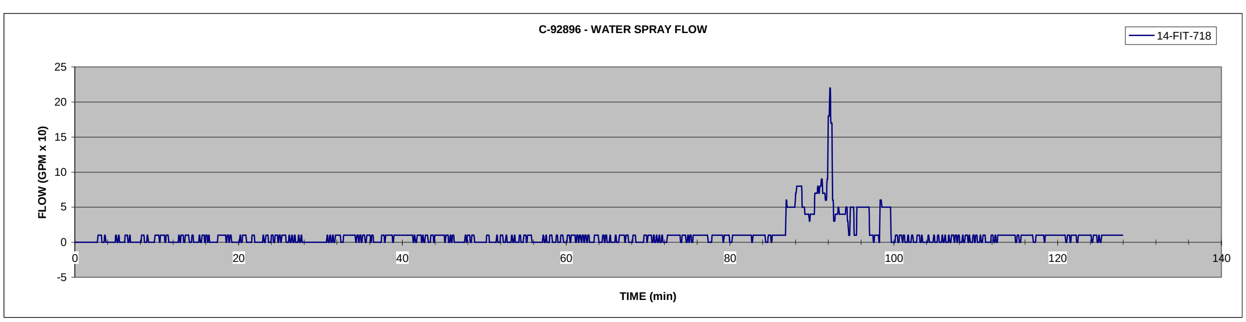



C-92896 - BURNER #2 FUEL
14-FIC-229
FLOW (SCFM x 10)
TIME (min)
0
50
100
150
200
250
20
40
60
80
100
120
140

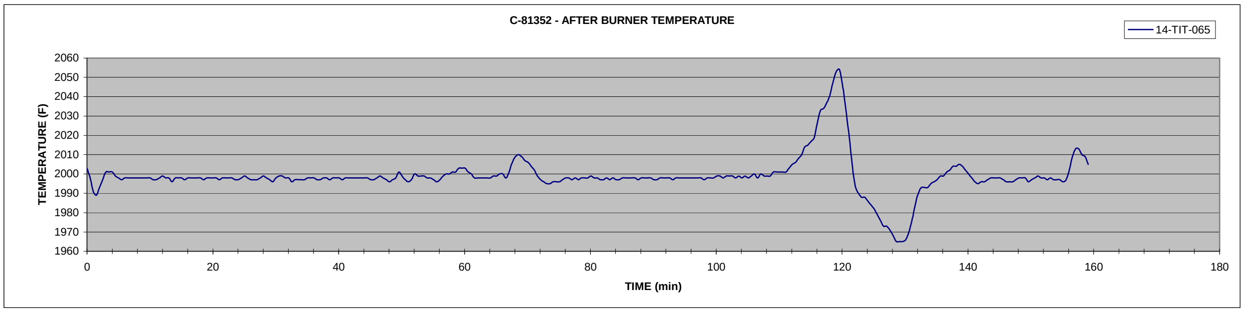

C-92896 - BURNER #3 FUEL
14-FIC-249
FLOW (SCFM x 10)
TIME (min)
0
50
100
150
200
250
20
40
60
80
100
120
140

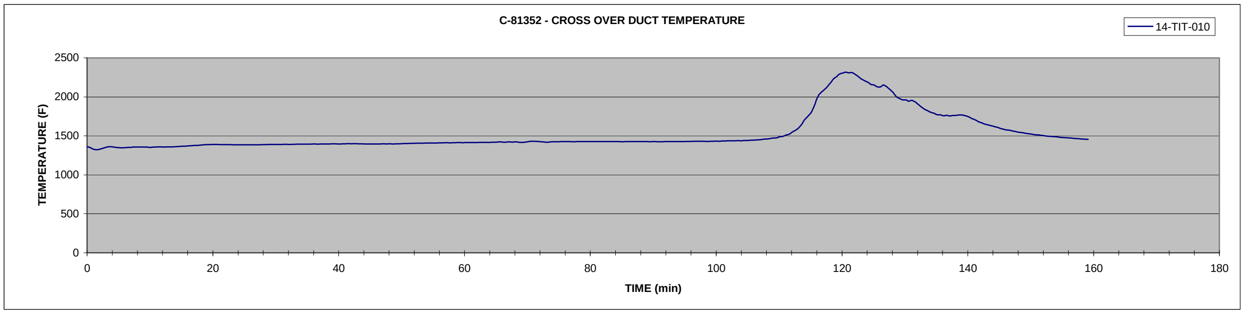

C-92896 - BURNER #4 FUEL
14-FIC-269
FLOW (SCFM x 10)
TIME (min)
0
50
100
150
200
250
20
40
60
80
100
120
140

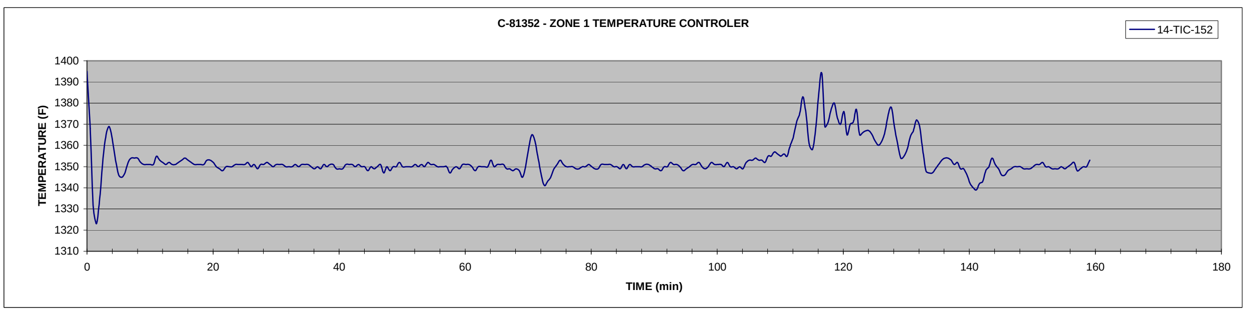

C-92896 - O_2 CROSS-OVER DUCT
14-AIT-033
O2 (% x 10)
TIME (min)
0
50
100
150
200
250
20
40
60
80
100
120
140

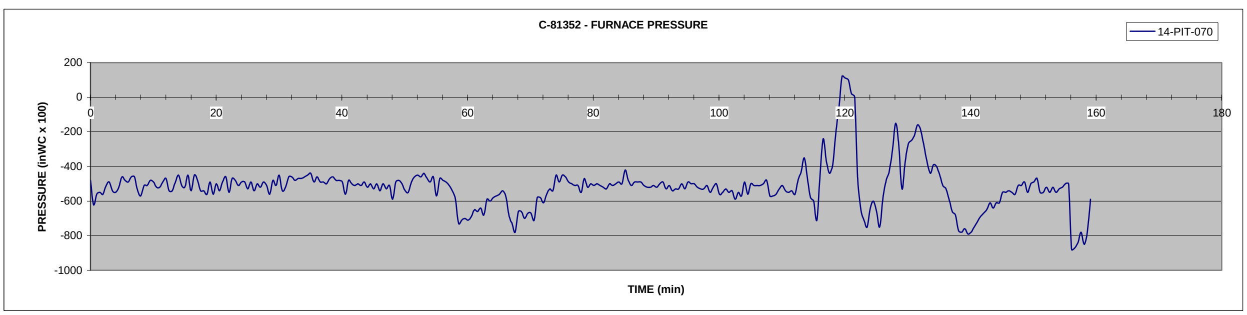

C-92896 - WATER SPRAY FLOW
14-FIT-718
FLOW (GPM x 10)
TIME (min)
-5
0
5
10
15
20
25
20
40
60
80
100
120
140

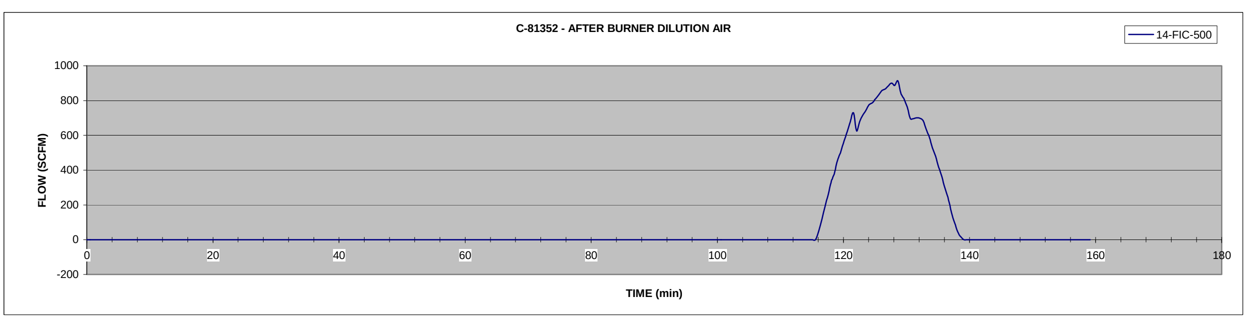
Appendix F – Child TC MPF Test # 17 (page 1 of 3)



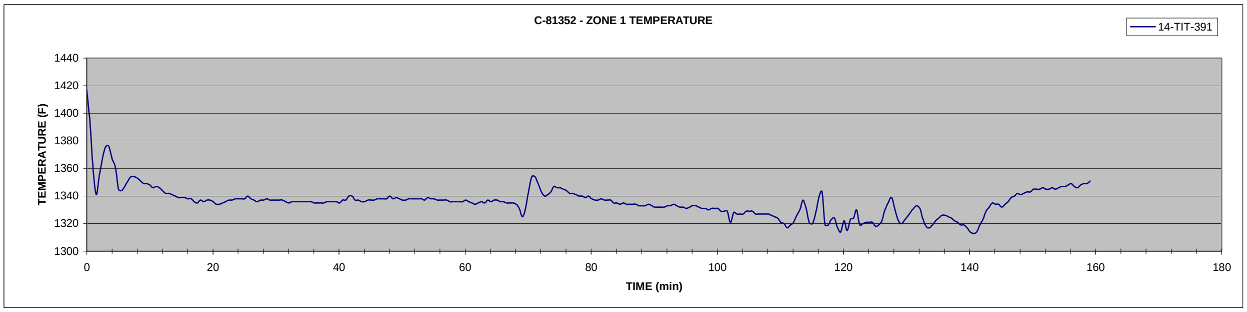


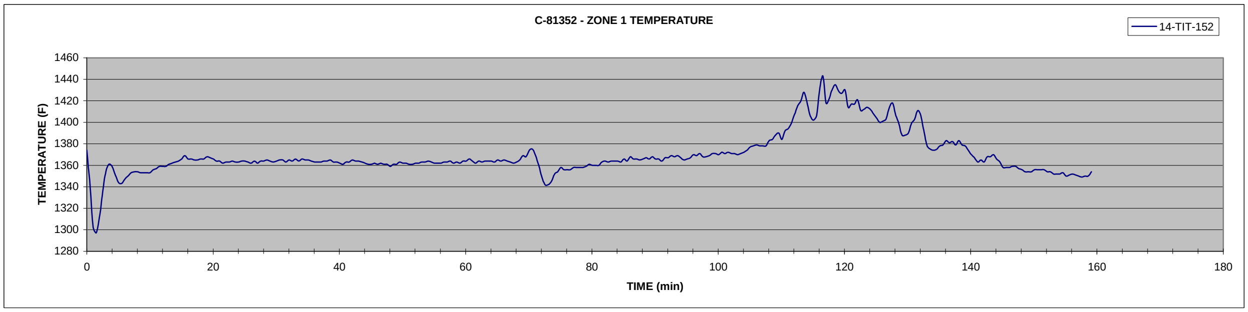


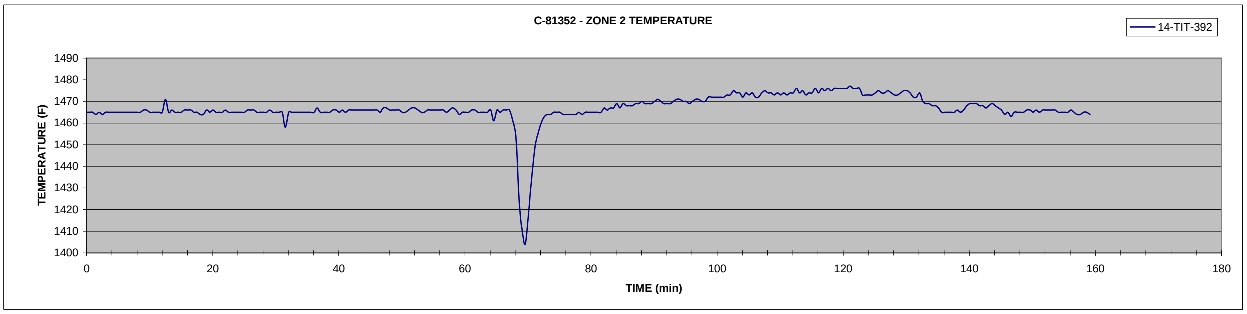


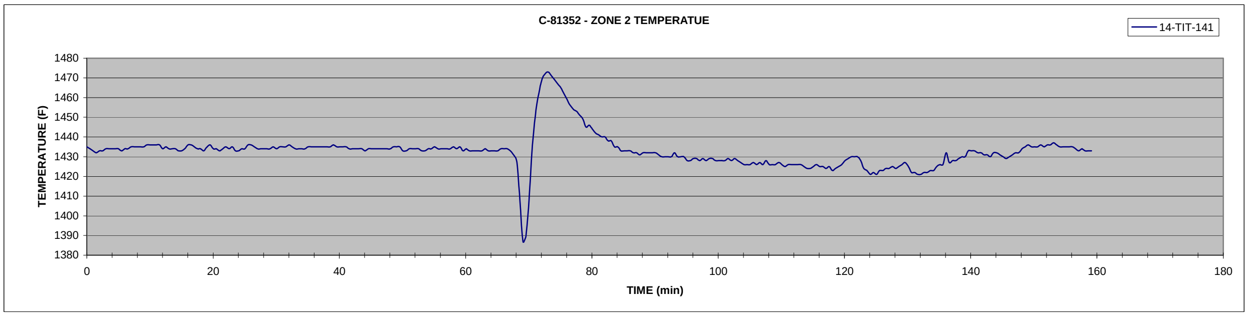


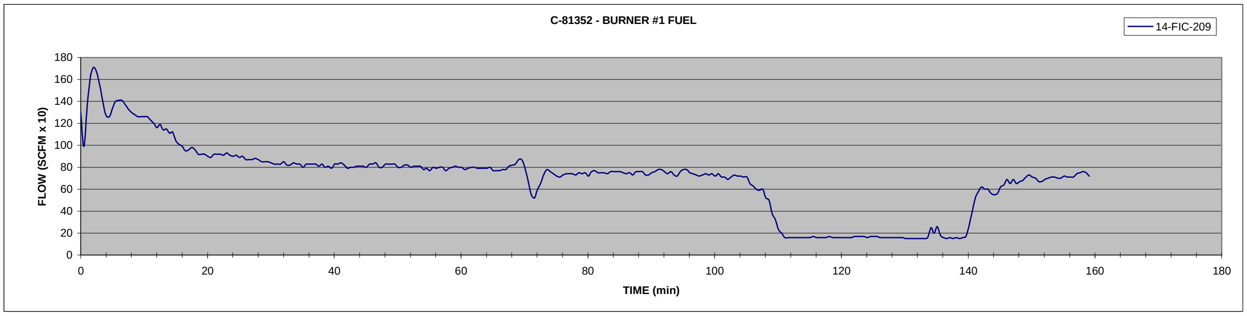
Appendix F – Child TC MPF Test # 17 (page 2 of 3)

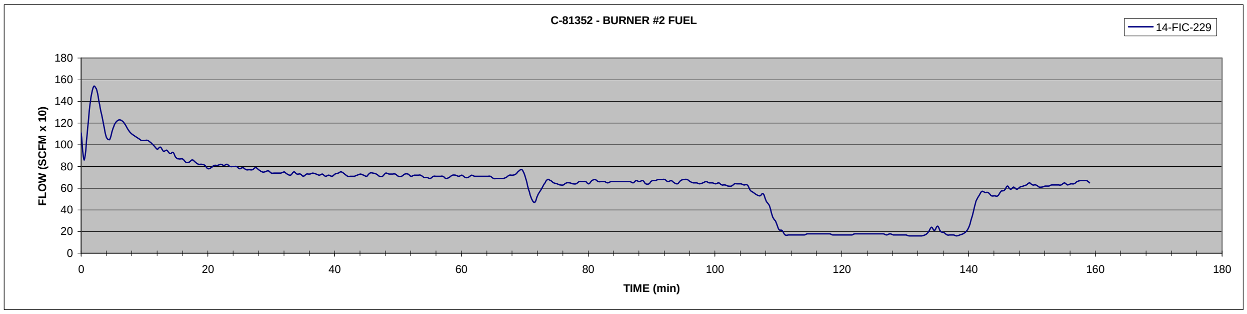


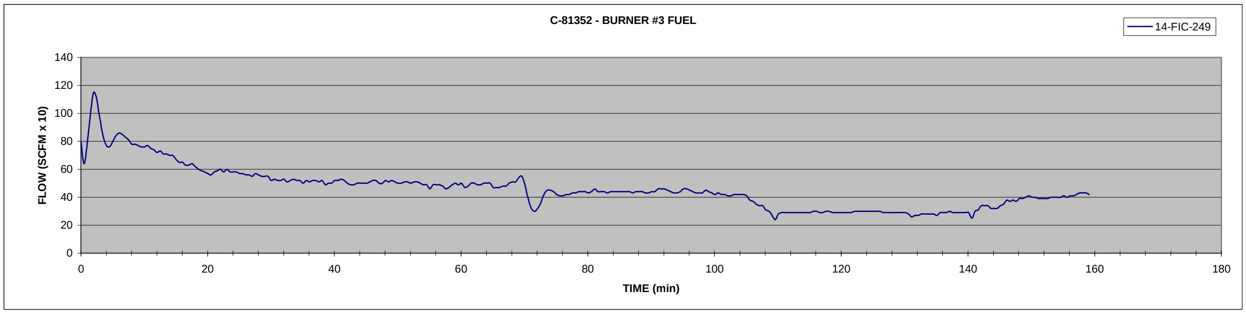


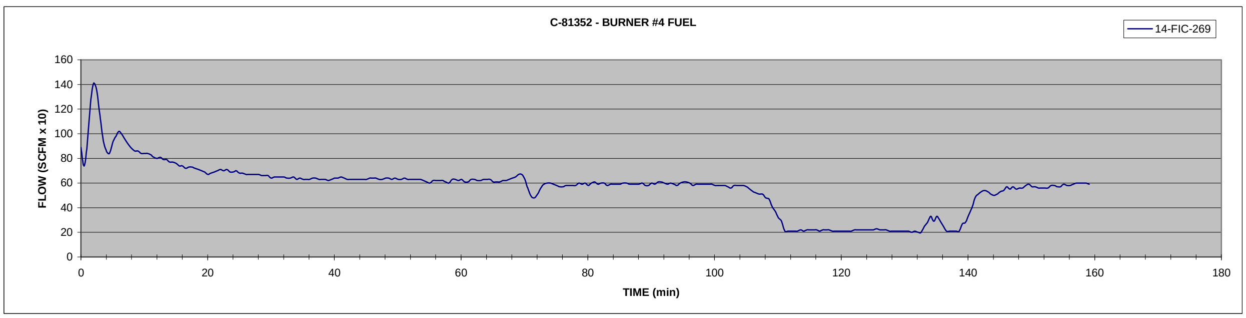


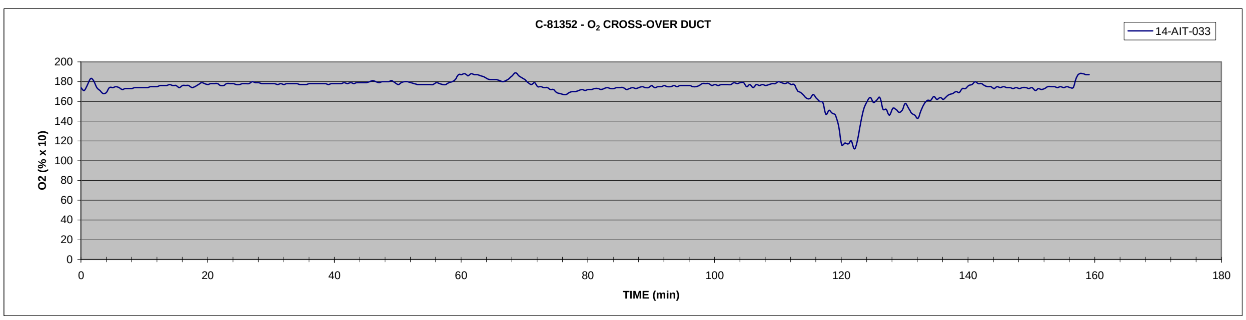


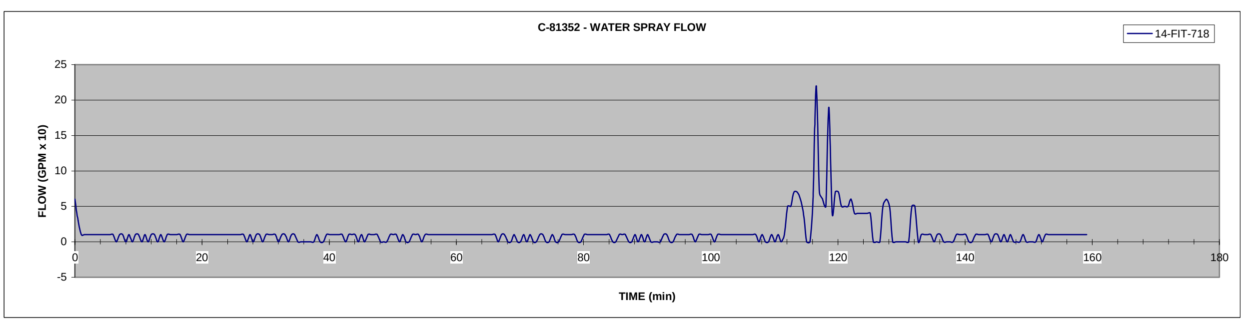


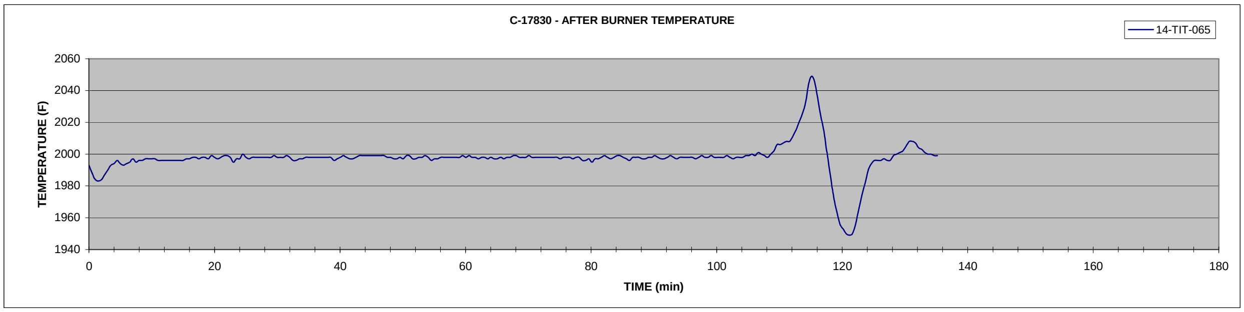

C-81352 - BURNER #2 FUEL
14-FIC-229
FLOW (SCFM x 10)
TIME (min)
0
20
40
60
80
100
120
140
160
180


C-81352 - BURNER #3 FUEL
14-FIC-249
FLOW (SCFM x 10)
TIME (min)
0
20
40
60
80
100
120
140
160
180

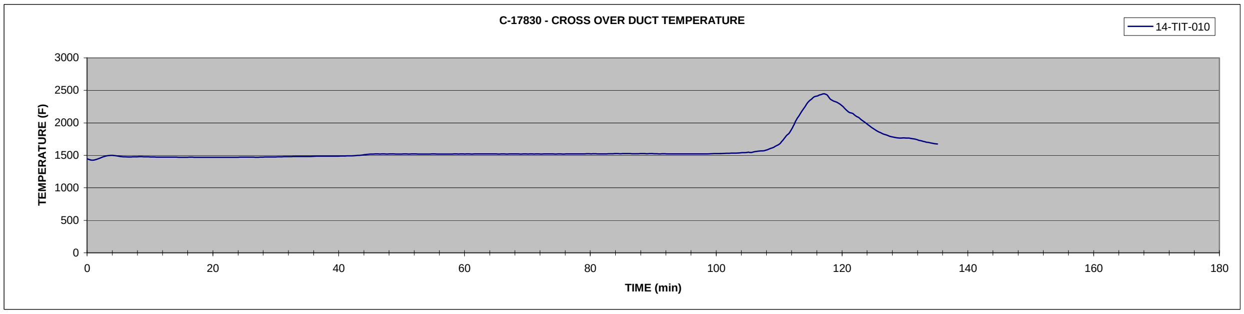

C-81352 - BURNER #4 FUEL
14-FIC-269
FLOW (SCFM x 10)
TIME (min)
0
20
40
60
80
100
120
140
160
180


C-81352 - O_2 CROSS-OVER DUCT
14-AIT-033
O2 (% x 10)
TIME (min)
0
20
40
60
80
100
120
140
160
180
200

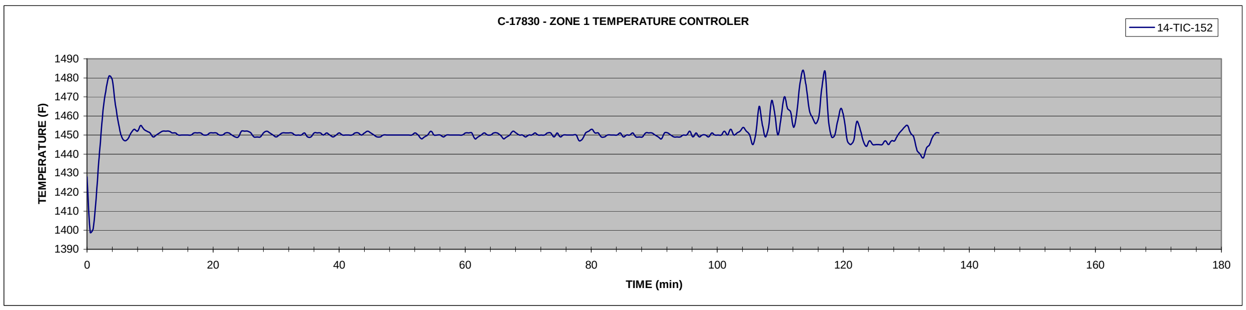

C-81352 - WATER SPRAY FLOW
14-FIT-718
FLOW (GPM x 10)
TIME (min)
-5
0
5
10
15
20
25
0
20
40
60
80
100
120
140
160
180



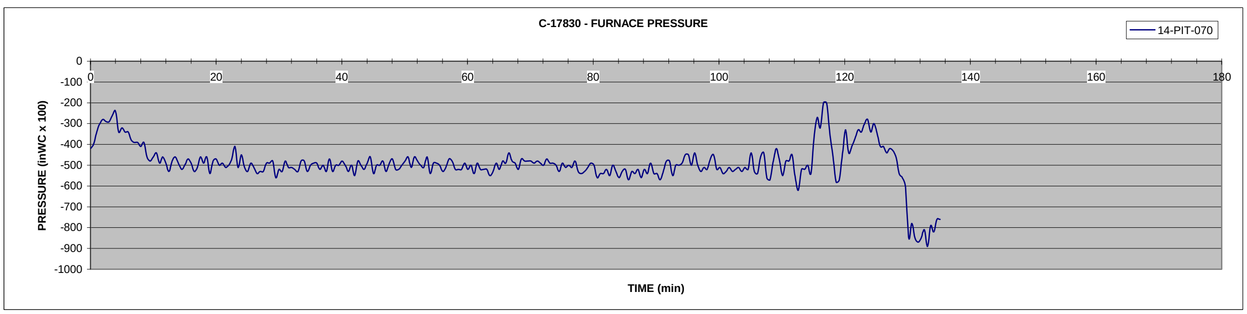
C-17830 - AFTER BURNER TEMPERATURE
14-TIT-065
TEMPERATURE (F)
2060
2040
2020
2000
1980
1960
1940
0
20
40
60
80
100
120
140
160
180
TIME (min)



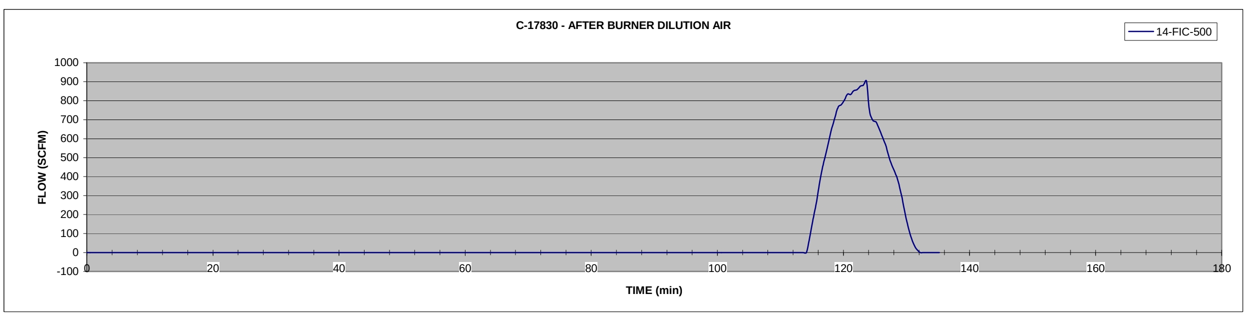
C-17830 - CROSS OVER DUCT TEMPERATURE
14-TIT-010
TEMPERATURE (F)
3000
2500
2000
1500
1000
500
0
0
20
40
60
80
100
120
140
160
180
TIME (min)



C-17830 - ZONE 1 TEMPERATURE CONTROLER
14-TIC-152
TEMPERATURE (F)
1490
1480
1470
1460
1450
1440
1430
1420
1410
1400
1390
0
20
40
60
80
100
120
140
160
180
TIME (min)

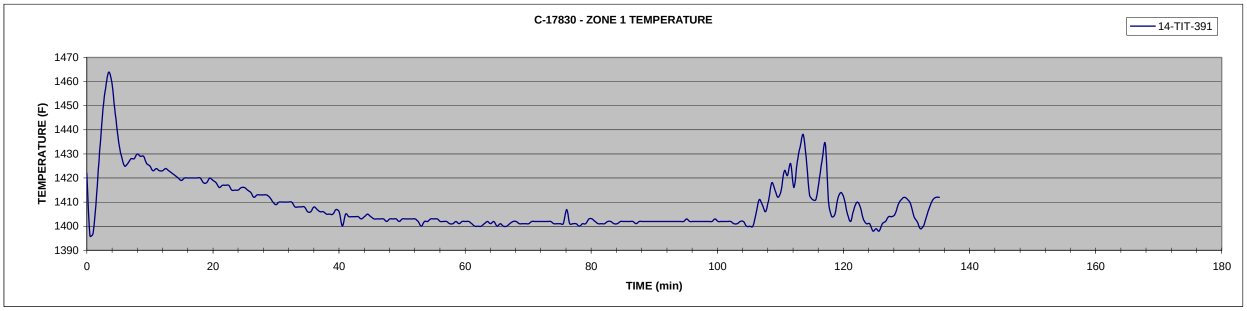


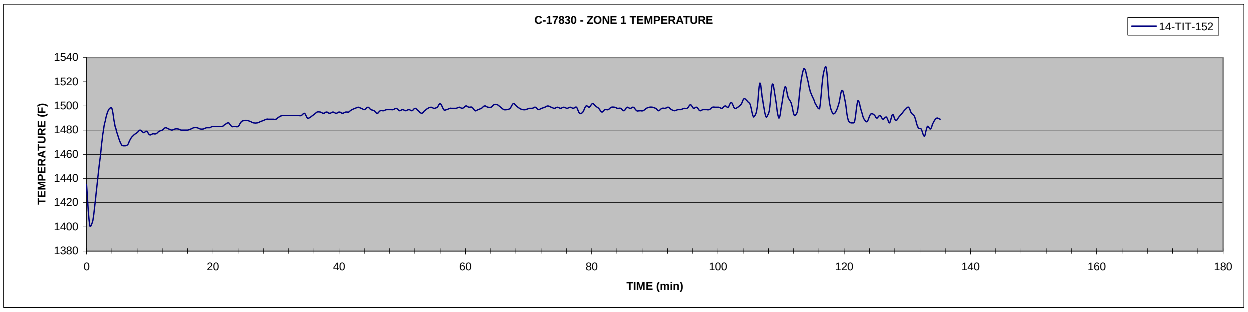
C-17830 - FURNACE PRESSURE
14-PIT-070
PRESSURE (inWC x 100)
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
-1000
0
20
40
60
80
100
120
140
160
180
TIME (min)

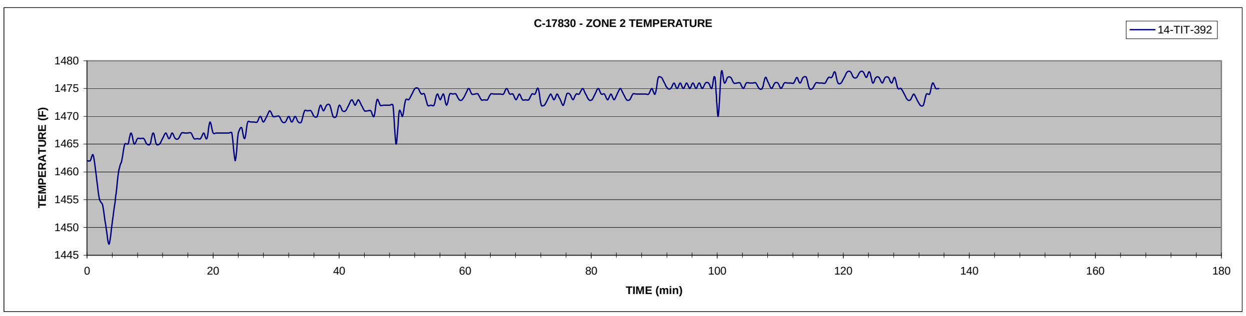


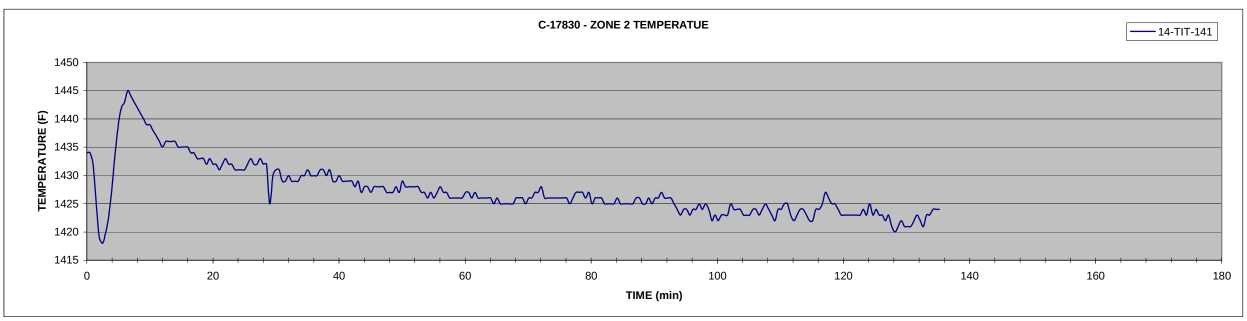
C-17830 - AFTER BURNER DILUTION AIR
14-FIC-500
FLOW (SCFM)
1000
900
800
700
600
500
400
300
200
100
0
-100
0
20
40
60
80
100
120
140
160
180
TIME (min)

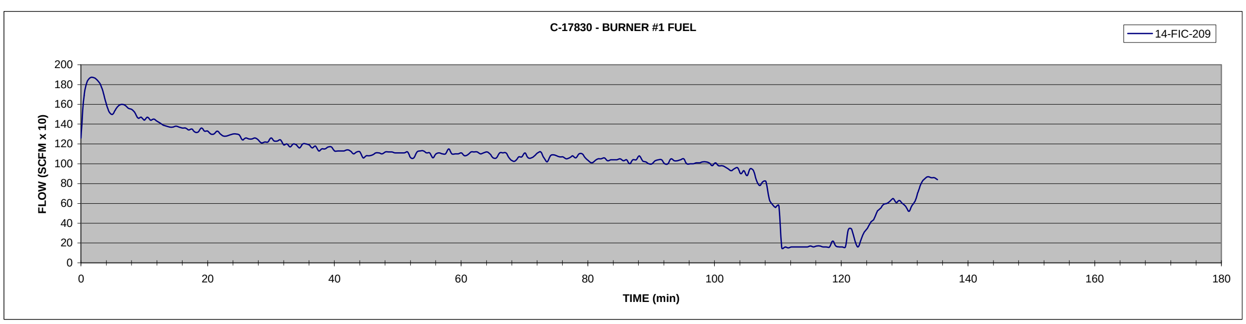
Appendix F – Child TC MPF Test # 18 (page 2 of 3)



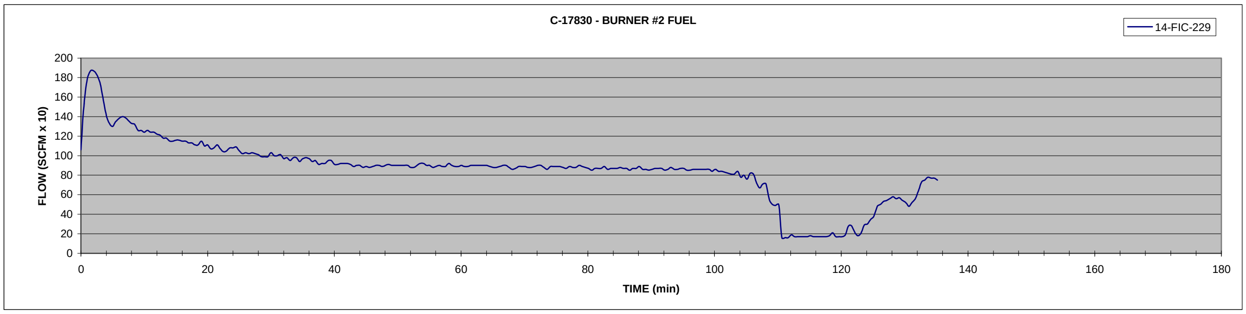


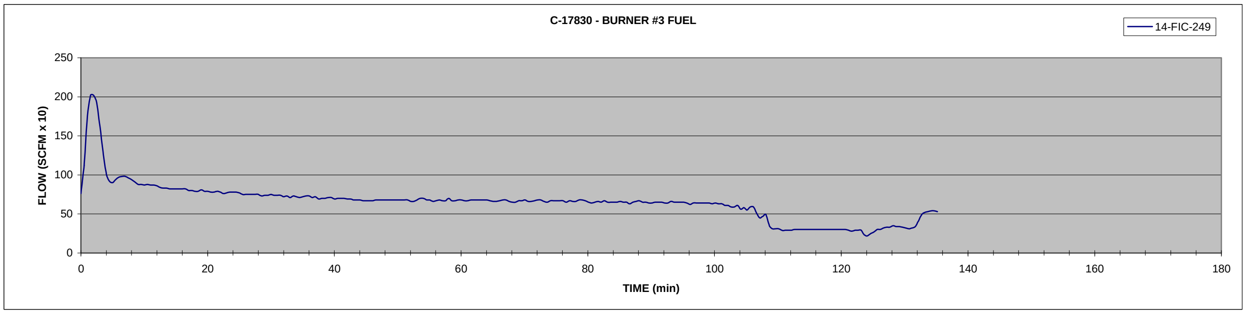


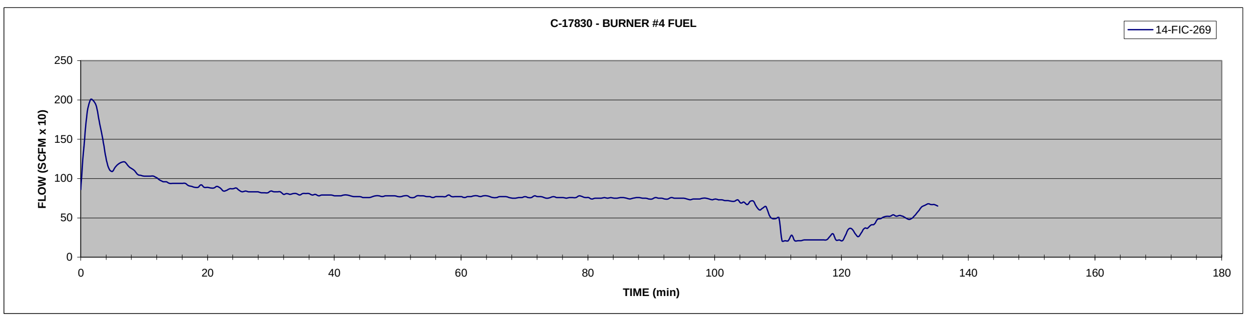


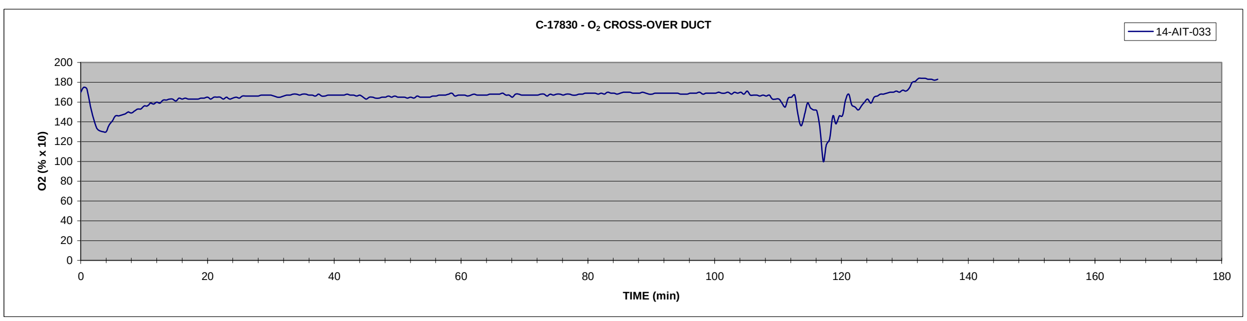


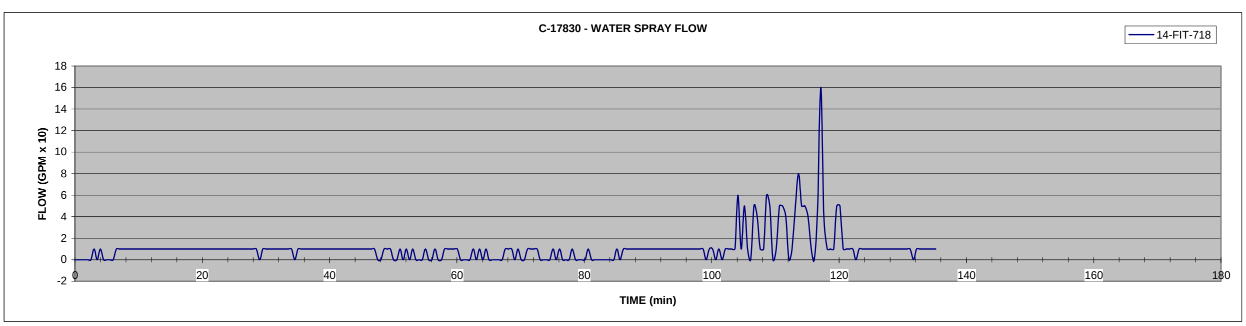
Appendix F – Child TC MPF Test # 18 (page 3 of 3)



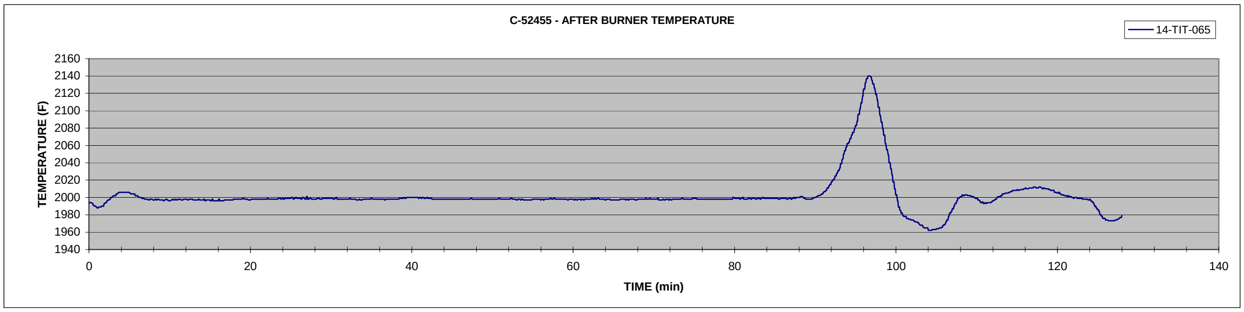


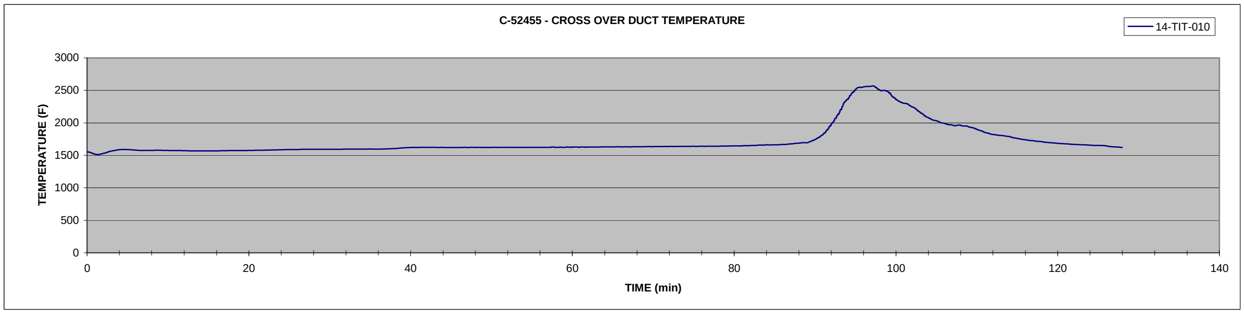


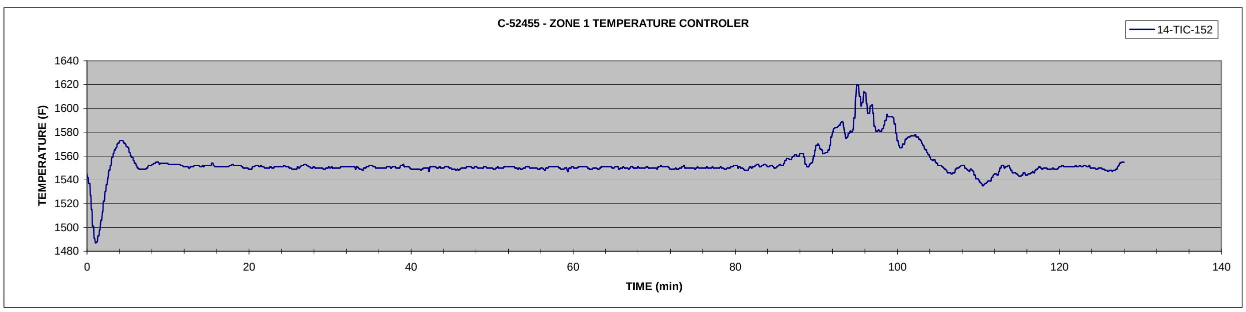


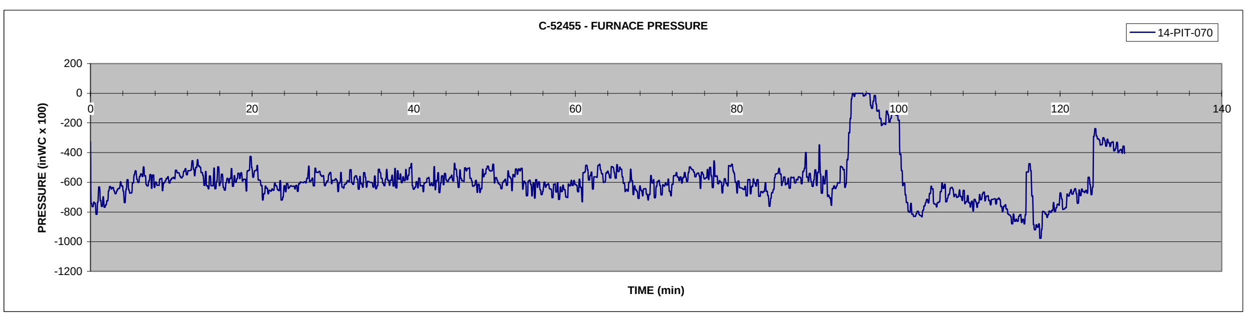


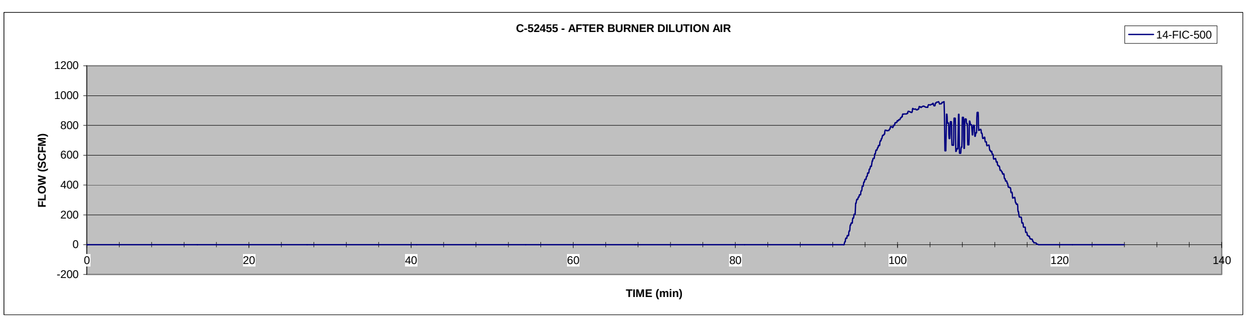
Appendix F – Child TC MPF Test # 19 (page 1 of 3)

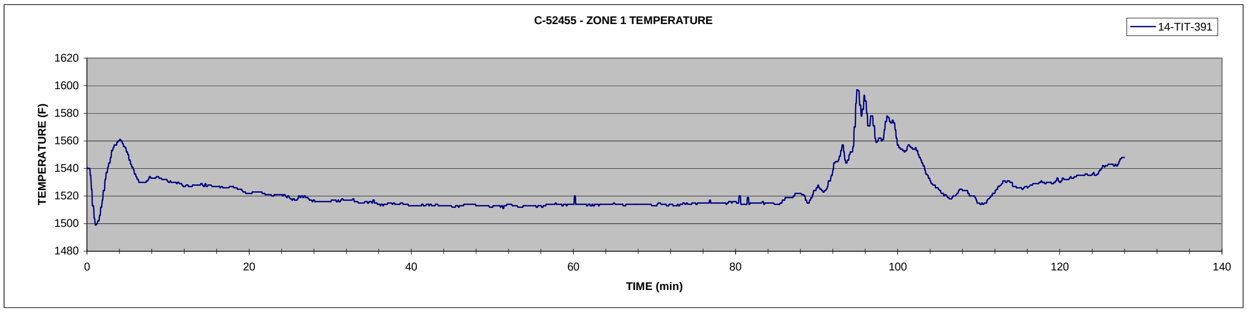


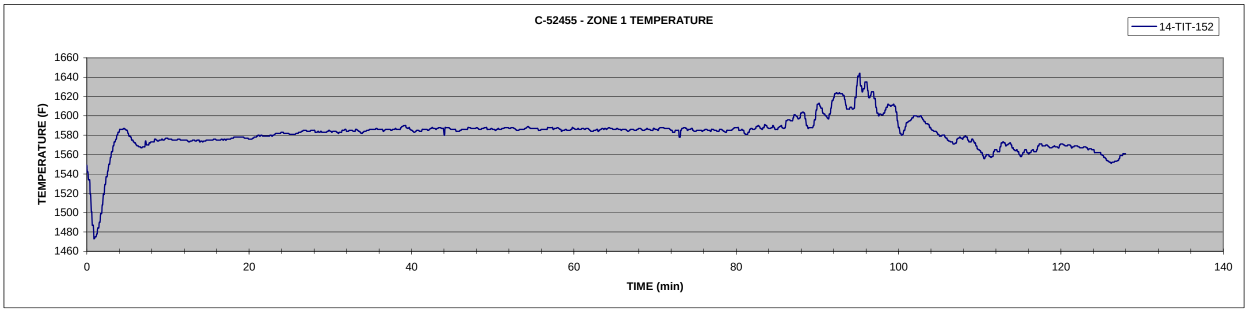


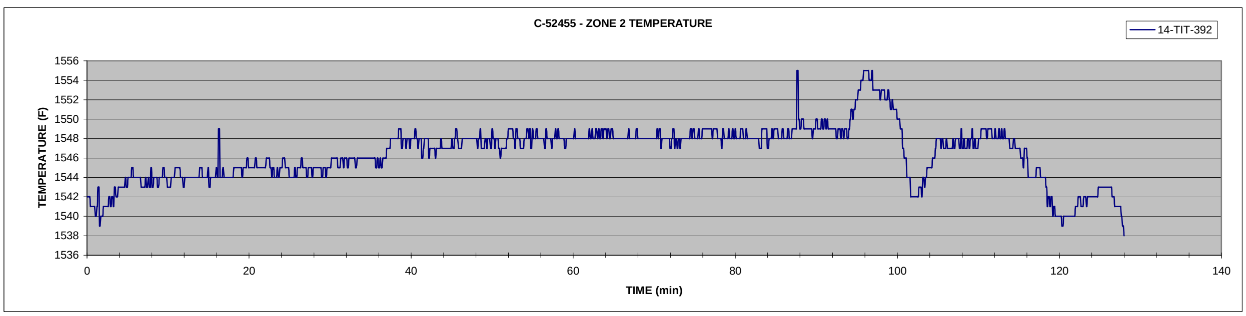


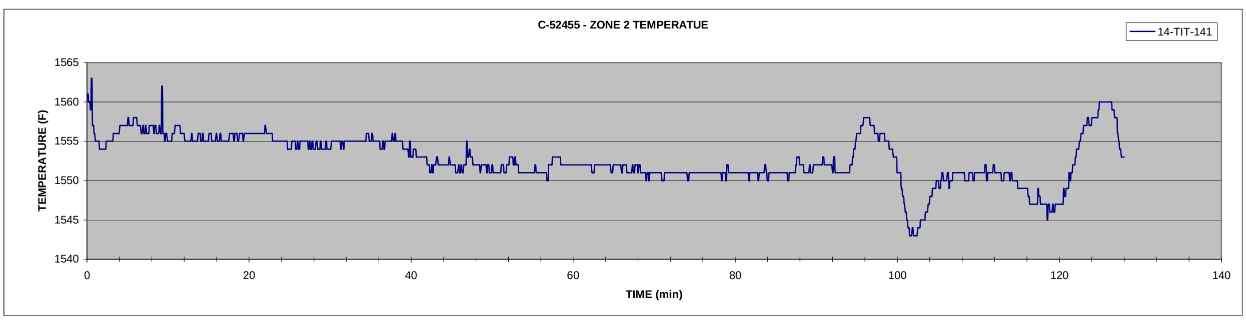


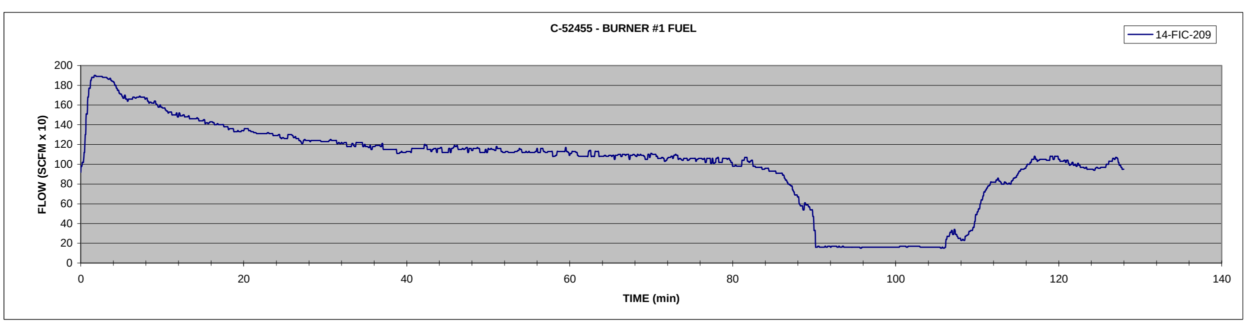


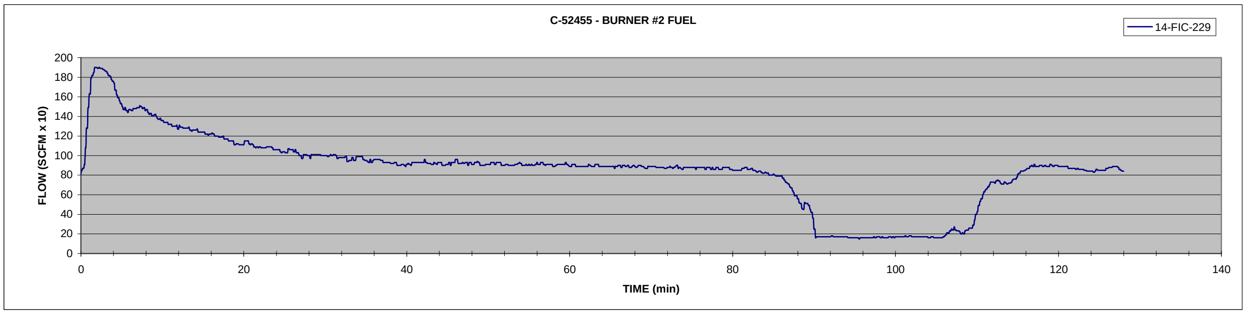

C-52455 - ZONE 1 TEMPERATURE
14-TIT-391
TEMPERATURE (F)
1620
1600
1580
1560
1540
1520
1500
1480
0
20
40
60
80
100
120
140
TIME (min)

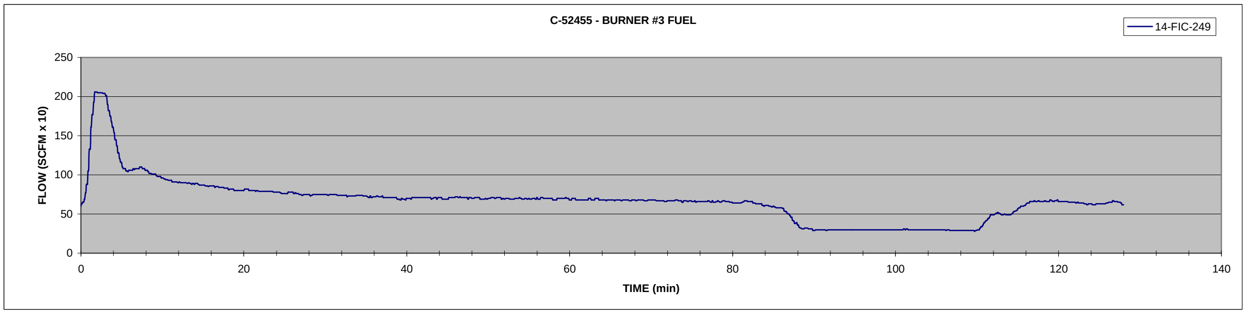

C-52455 - ZONE 1 TEMPERATURE
14-TIT-152
TEMPERATURE (F)
1660
1640
1620
1600
1580
1560
1540
1520
1500
1480
1460
0
20
40
60
80
100
120
140
TIME (min)

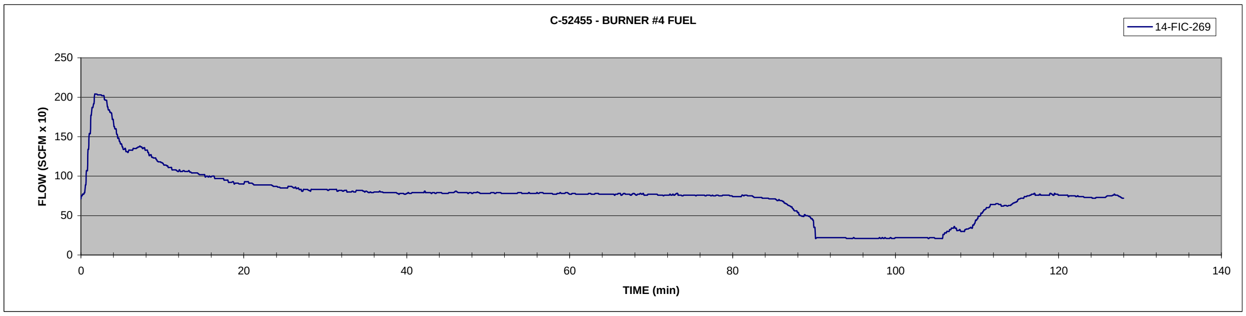

C-52455 - ZONE 2 TEMPERATURE
14-TIT-392
TEMPERATURE (F)
1556
1554
1552
1550
1548
1546
1544
1542
1540
1538
1536
0
20
40
60
80
100
120
140
TIME (min)

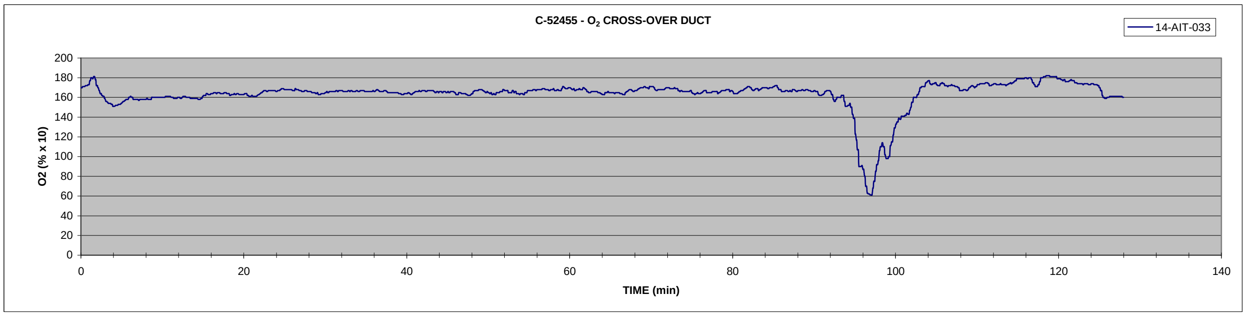

C-52455 - ZONE 2 TEMPERATUE
14-TIT-141
TEMPERATURE (F)
1565
1560
1555
1550
1545
1540
0
20
40
60
80
100
120
140
TIME (min)

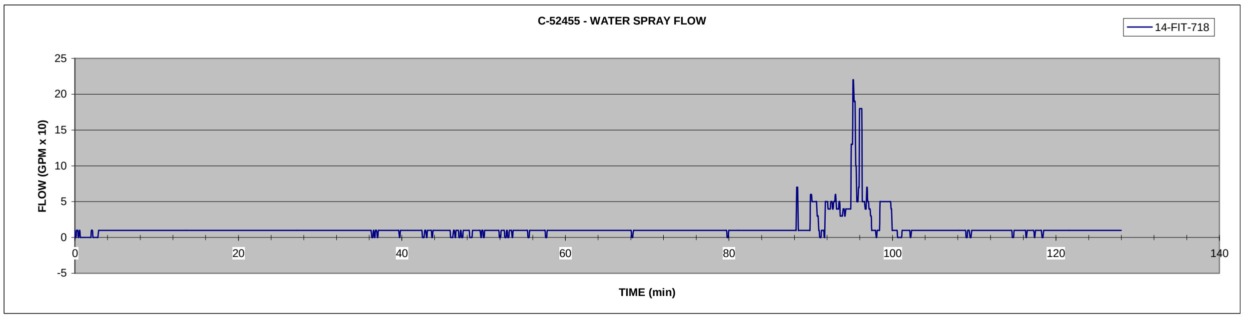

C-52455 - BURNER #1 FUEL
14-FIC-209
FLOW (SCFM x 10)
200
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
TIME (min)

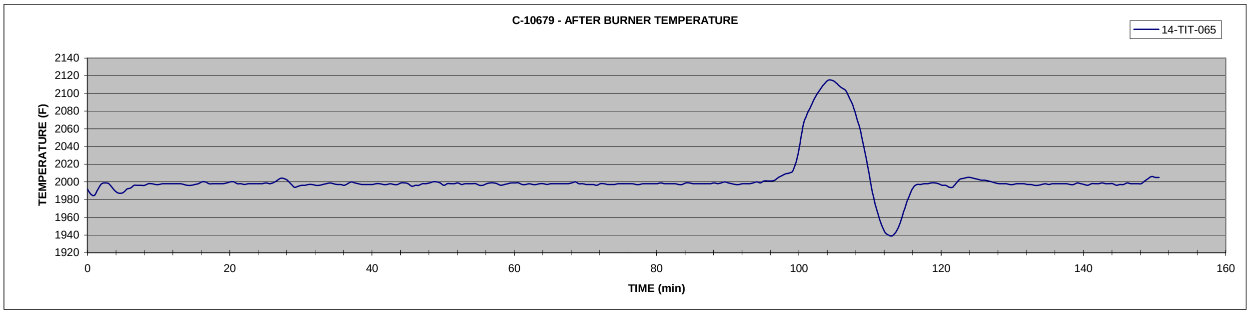

C-52455 - BURNER #2 FUEL
14-FIC-229
FLOW (SCFM x 10)
TIME (min)

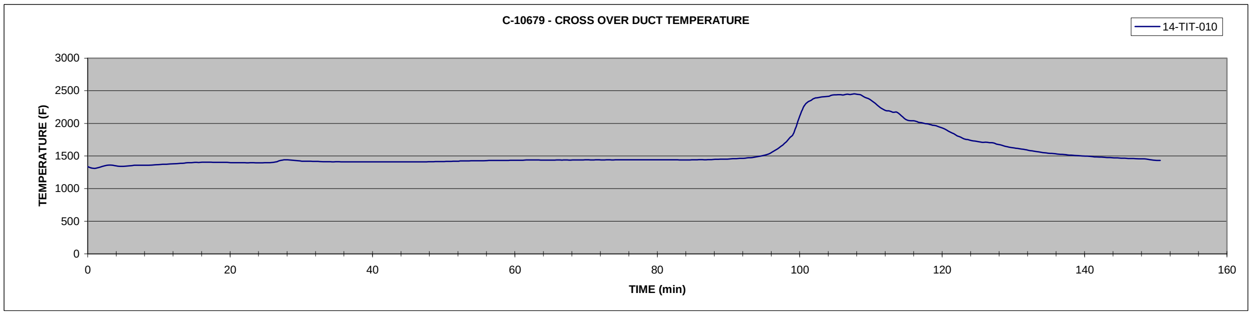

C-52455 - BURNER #3 FUEL
14-FIC-249
FLOW (SCFM x 10)
TIME (min)

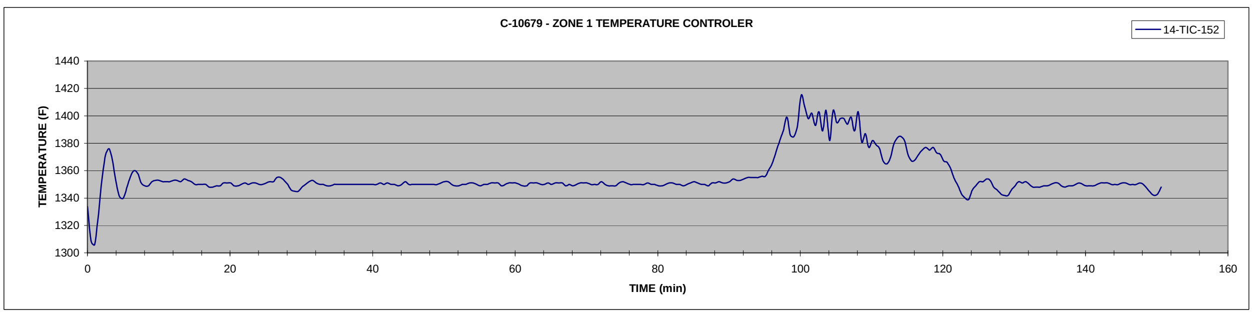

C-52455 - BURNER #4 FUEL
14-FIC-269
FLOW (SCFM x 10)
TIME (min)

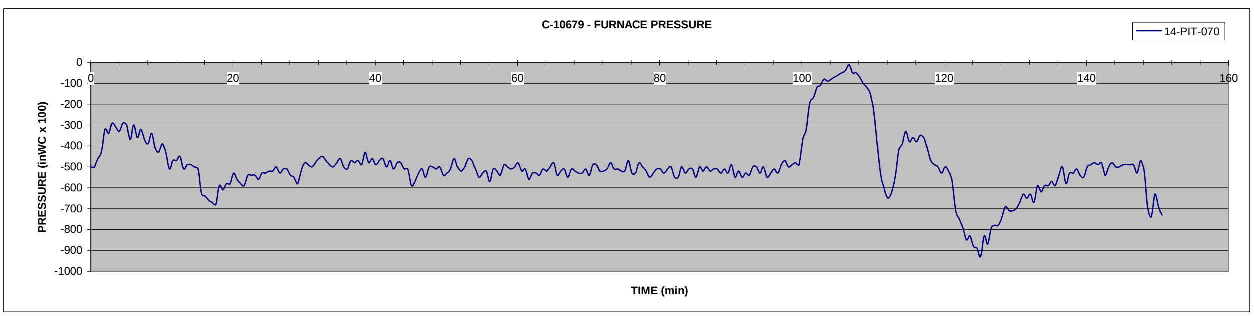

C-52455 - O_2 CROSS-OVER DUCT
14-AIT-033
O2 (% x 10)
TIME (min)

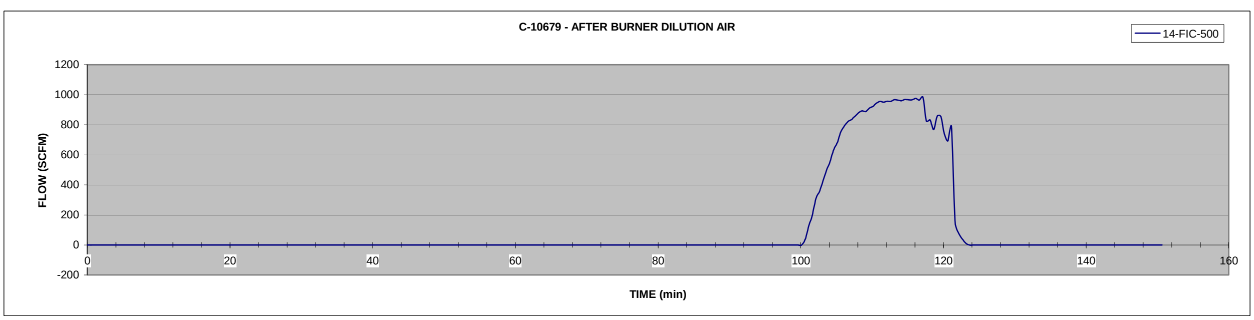

C-52455 - WATER SPRAY FLOW
14-FIT-718
FLOW (GPM x 10)
TIME (min)


C-10679 - AFTER BURNER TEMPERATURE
14-TIT-065
TEMPERATURE (F)
2140
2120
2100
2080
2060
2040
2020
2000
1980
1960
1940
1920
0
20
40
60
80
100
120
140
160
TIME (min)

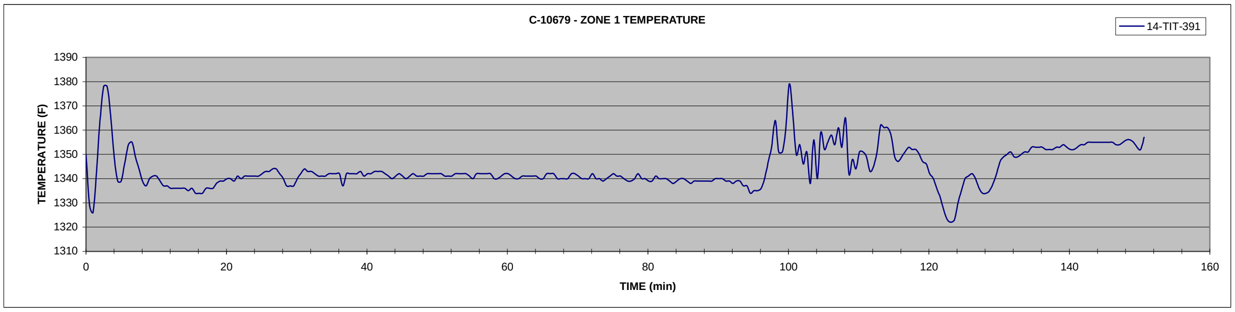

C-10679 - CROSS OVER DUCT TEMPERATURE
14-TIT-010
TEMPERATURE (F)
3000
2500
2000
1500
1000
500
0
0
20
40
60
80
100
120
140
160
TIME (min)

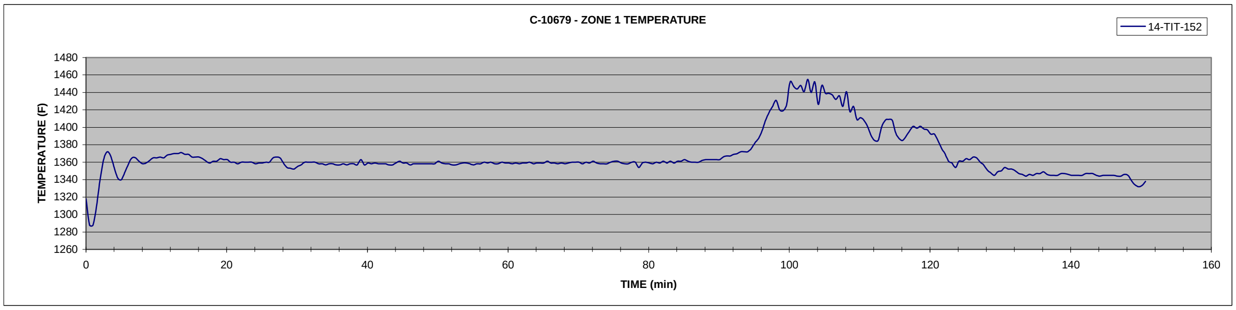

C-10679 - ZONE 1 TEMPERATURE CONTROLER
14-TIC-152
TEMPERATURE (F)
1440
1420
1400
1380
1360
1340
1320
1300
0
20
40
60
80
100
120
140
160
TIME (min)

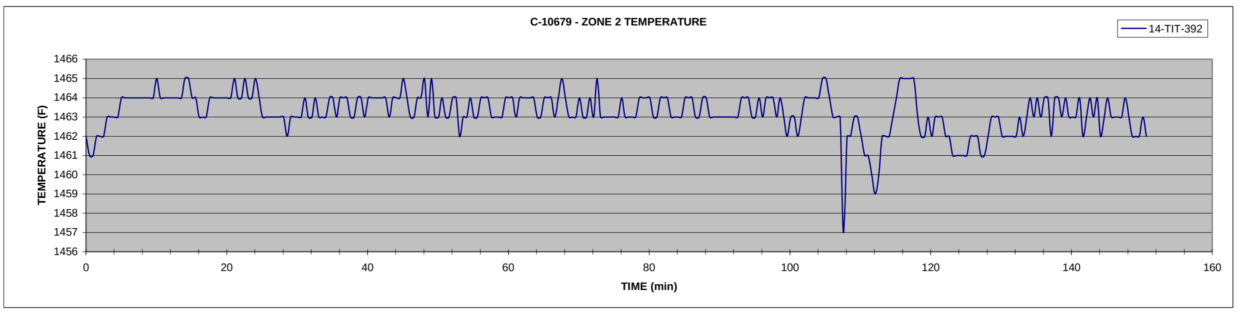

C-10679 - FURNACE PRESSURE
14-PIT-070
PRESSURE (inWC x 100)
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
-1000
0
20
40
60
80
100
120
140
160
TIME (min)

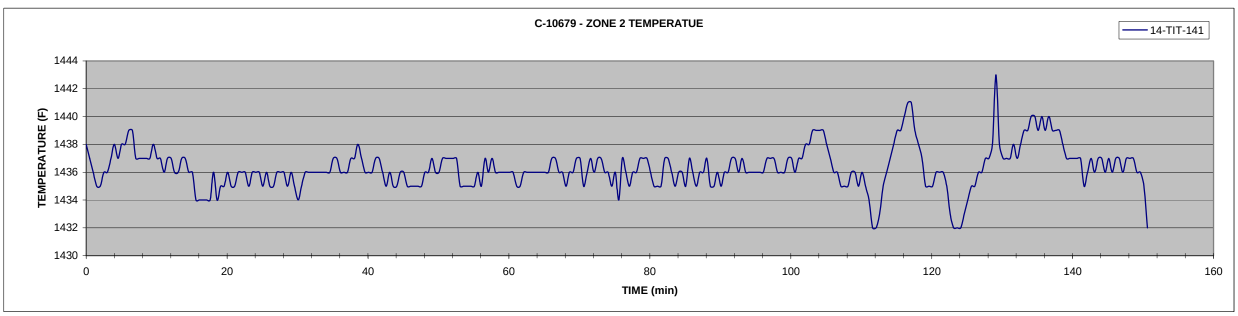

C-10679 - AFTER BURNER DILUTION AIR
14-FIC-500
FLOW (SCFM)
1200
1000
800
600
400
200
0
-200
0
20
40
60
80
100
120
140
160
TIME (min)

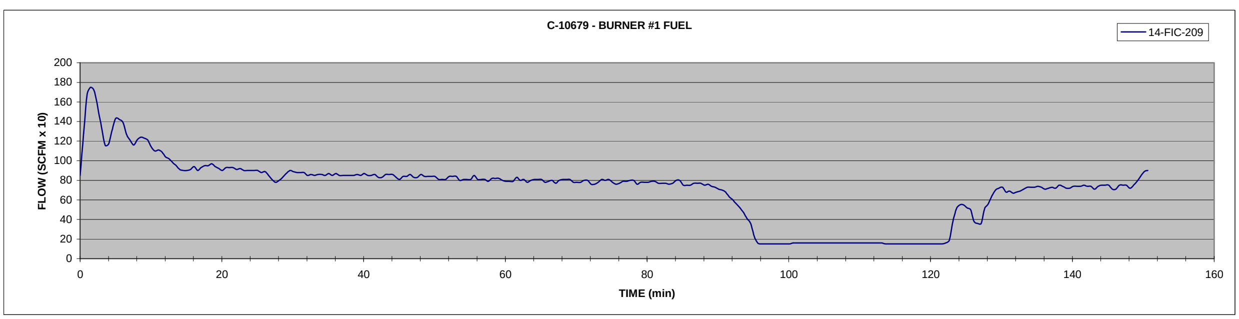
Appendix F – Child TC MPF Test # 20 (page 2 of 3)











Appendix F – Child TC MPF Test # 20 (page 3 of 3)